ENGINEERING NEWS-RECORD

Concrete and steel frame buildings that house atomic diffusion processes at Oak Ridge, Tenn.

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[PUMP TIPS FROM ALLIS-CHALMERS — ONE IN A SERIES]

How to make BEARINGS Last Longer . . .

ONE OF THE MAIN CAUSES of bearing trouble is misalignment. For when pump and its driving motor are not correctly aligned, every revolution of the shaft throws tremendous extra load on all moving parts within the pump's closely fitted body — resulting in greatly accelerated wear, oftentimes in complete bearing failure.

In an effort to eliminate the misalignment factor, A-C developed, for many applications, the "Electrifugal" pump — in which both motor and pump impeller are mounted on one shaft and in one frame. This *unit-design* prevents shaft from getting out of line . . . minimizes possibility of excessive bearing wear.

However, many pumps in use today are coupled to *separate* driving motors. In guarding against misalignment in this type pump, see that coupling flanges are perfectly aligned — and that they're kept that way!

Allis-Chalmers "Electrifugal" Pumps are equipped with two large ball bearings which support *both* the rotor and runner on one shaft.

Regardless of whether your pumps are equipped with ball, roller or sleeve bearings, here are a few maintenance tips that can prove useful to you in getting longer life out of bearings:

▶ Although too much oil won't harm sleeve bearings, too much grease in anti-friction type bearings will *promote* friction and heat. Main job of grease in anti-friction bearings is to protect steel elements against corrosion, not friction.

▶ No one rule on lubrication frequency fits all pump installations. So play safe: if anything, change lubricant *before* it's too worn or too dirty.

▶ Once a month, check bearing temperatures with a thermometer . . . *not by hand.*

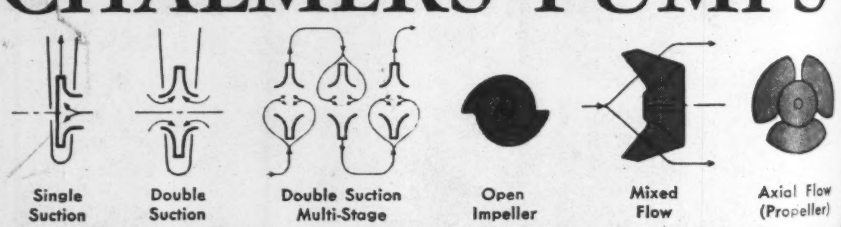
▶ In the case of sleeve bearings, measure bearings for wear every three months, replacing them if wear is excessive. Generally allow two-thousandths of an inch clearance — plus one-thousandth of an inch for each inch of shaft journal diameter.

▶ Every three months, drain lubricant, washing out oil well and bearings with kerosene. In the case of sleeve bearings, check to see that oil rings are free to turn with the shaft.

▶ If you haven't done so already, send for Allis-Chalmers *free* "Handbook for Wartime Care of Centrifugal Pumps". Applies to *all* makes of pumps; contains *no* advertising. Contents include: valuable tables on friction losses; handy guide to locating trouble; wartime maintenance schedule. Address your request to ALLIS-CHALMERS MFG. CO., MILWAUKEE 1, WIS.

ALLIS-CHALMERS PUMPS

Allis-Chalmers builds all types and variations of pumps shown at right. Capacities from 10 to 150,000 gpm—heads to 2500 lbs.



The Week In Engineering and Construction

ENGINEERING NEWS-RECORD • AUGUST 30, 1945 • VOLUME 135 • NUMBER 9

Building materials supply may prove to be adequate

Numerous local shortages of some materials now exist but adequate supplies expected to be available soon, according to WPB survey

Although a number of tight situations still exist, most construction materials are expected to be available in sufficient supply to meet actual demands of the industry in the very near future, a survey by the War Production Board indicates. Based upon a checkup made immediately after Japan asked for peace, the overall picture is a bright one, although some materials are short in supply at present.

Even lumber, which was generally expected to be the big bottleneck in starting postwar construction, should soon be available in sufficient quantity to launch a big program, as detailed on page 3 of this issue.

The situation in regard to specific materials is as follows:

Steel—Structural steel, plate, reinforcing bars, are somewhat easier than in the past few weeks, as are sheet and strip. Reinforcing mesh easier, warehouse stock, except sheet and strip, fair to good.

Cast Iron Soil Pipe—Conditions show no betterment. Orders are very heavy and increasing, with production and shipment not increasing. A very tight situation.

Cast Iron Pressure Pipe—No improvement in production. A slight increase in unfilled orders, but situation is not improving.

Portland Cement—Supply adequate except on the Pacific Coast.

Concrete Products—Building blocks and pipe are both in fair production and stock.

Insulation Board—Subject to delivery delays, production not increasing.

Hardboard—Is in tight condition with no relief in sight.

Laminated Fiber Board—Essential requirements are being met. Civilian construction and maintenance and repair orders subject to delay.

Gypsum Board—Production increasing, orders rapidly increasing. Situation threatens to become serious.

Asphalt Roofing—Production in general is meeting essential demands though increasing demands may change present delivery schedules.

Asphalt—Is in ample supply.

Unglazed, Common and Face Brick—Nationally, unfilled orders exceed stocks, and backlog is increasing, though production generally increased.

Structural Clay Tile—The total of unfilled orders exceeds stocks, and is increasing. Production not increasing. Conditions are not improving.

Vitrified Paving Brick—Is in good supply.

Glazed Brick—Production increased, stocks fair, demands irregular.

Glazed Hollow Facing Tile—Production steady, backlog of unfilled orders is not increasing and stocks are ample.

Unglazed Hollow Facing Tile—Production and shipments, generally increased. Stock position good.

Clay Sewer Pipe—Production, shipments, and stocks remain steady.

Floor and Wall Tile—Production below demands, with long delays in delivery.

Cement Asbestos Corrugated Sheets—Is in increasingly tight supply.

Cement Asbestos Flat Sheets—Are in short supply.

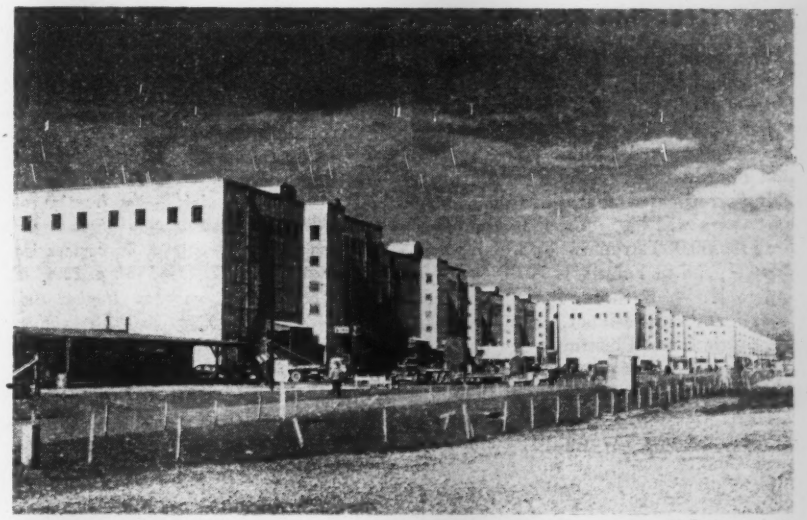
Cement Asbestos Pipe—Is in easy position.

Cement Asbestos Shingles—Subject to long delivery delays.

Lumber—See page 3.

Hardwood Flooring—Is in short supply, with little stock and probable pro-

(*Continued on next page*)



U. S. Army photo

Simple structures serve atomic plants

In contrast to entirely new and radically different equipment required for atomic separation, the structures used to house the processes are simple and conventional buildings. Earlier buildings were built with concrete frames, where practical, while later ones utilize concrete for the frame of lower stories with steel above the second floor level.

This building, at Clinton Engineer Works, Tennessee, is typical of the economical fireproof exterior covering used at one plant. Other units used asphalt-coated steel sheets or structural tile for similar protection from the danger of fire.

duction for 1945 to be all booked up.

Shingles—Production and supply is low.

Plywood—Little is available for general construction.

Plumbing—No changes during the past month. Restrictions on production, and on metal uses removed. Substantial and progressive increase in available products anticipated.

Heating Equipment — Equipment stocks, in general, are in short supply, but obtainable, subject to varying delays.

Non-Electric Domestic Equipment—Ranges, etc., delivery delays are reducing, with improvement in production.

Brass and Copper Goods—In improved position, and should soon be in available supply.

Electric Devices and Lighting Fixtures—Available subject to delays.

Elevators—In easier condition.

Fire Equipment—In fair supply, except hose and sprinklers.

Hardware and Metal Building Materials—Generally, in improved condition, except metal screen cloth. Improvement in screen cloth expected.

Electrical Domestic Ranges—Food preparation equipment is available in limited quantities, and subject to delays.

Mechanical Domestic Refrigeratotrs—Still in frozen inventory, with increase authorized.

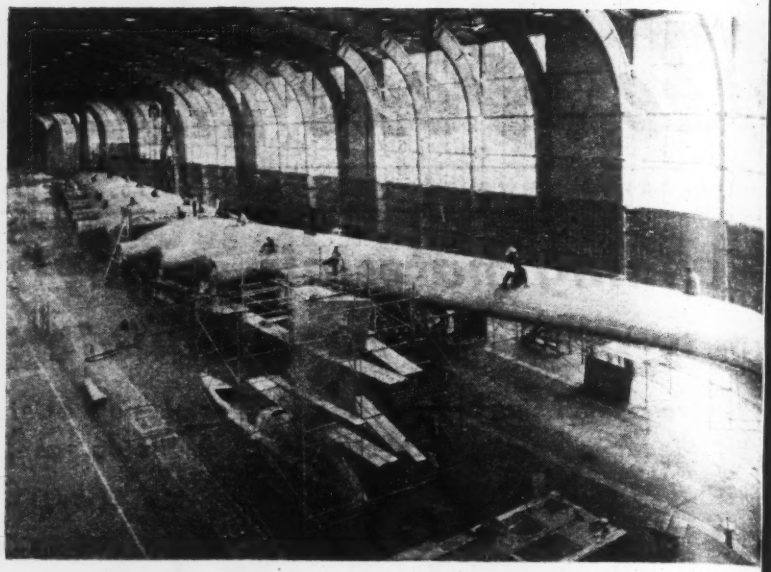
• • •

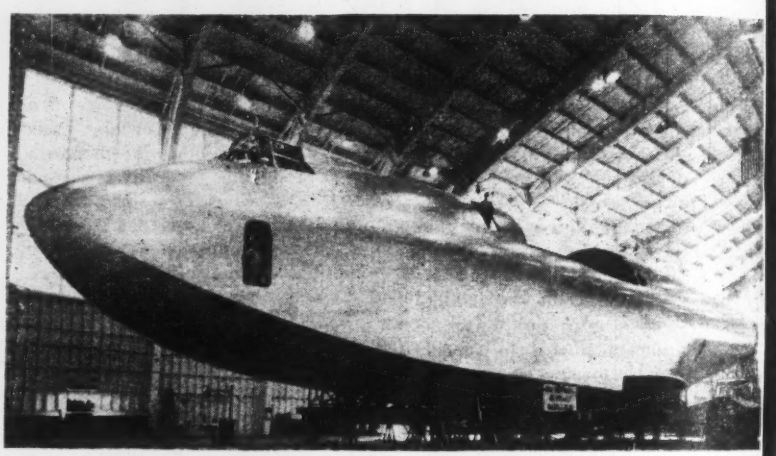
WPB allows Davis Dam construction to resume

Clearance to continue construction of Davis Dam on the Colorado River, third largest earth and rock-fill dam undertaken by the Bureau of Reclamation, has been granted by the War Production Board.

It is estimated that three and one-half years will be required to complete the $19,000,000 structure on which work was stopped in February, 1943. According to H. W. Bashore, Bureau of Reclamation commissioner, supplemental appropriations to continue construction will be asked from Congress this fall in order that work may begin in 1946.

Davis Dam, below Boulder Dam, is located in Clark County, Nev., and Mojave County, Ariz. It will be 200 ft. high, and power installations will have a capacity of 225,000 kw. (*EN-R*, July 9 '42, vol. p. 71).





Largest air boat is built under laminated arches

"Now it can be told"—the function of the building supported on novel three-hinged laminated arches described in Engineering News-Record, Feb. 22, 1945, vol. p. 250. In this huge industrial workshop Hughes Aircraft Co. of Culver City, Calif., is building the gigantic Hughes Cargo Plane H-4. Behind partially completed hull and wing panel sections can be seen the arch ribs of the 120-ft. span and 72-ft. rise of the laminated timber frame that had to be designed and completed before the world's largest flying boat could take shape.

Pictured at the top in dihedral position during mating are the H-4 wing panels, 320 ft. in length. Wings are designed to permit an allowable vertical deflection of the wing tips of 18 ft. To the eight nacelles shown will be mounted engines each with a rated capacity of 3,000 hp., giving a total power equal to that of eight locomotives.

Shown at the bottom in its final coat of aluminum lacquer is the 218-ft.-long H-4 hull. Cutaway section is the space provided for mating wings to hull. Overall height of the hull is 30 ft., and height from keel to top of vertical stabilizer is 84 ft.

Of all wood construction, the H-4 will have a gross weight of 400,000 lbs., a maximum fuel capacity of 14,000 gals.

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Adequate lumber will be available for construction in 30 days

Most controls removed because of big reduction in Army and Navy needs—May be lack of dried lumber in some sizes

In about 30 days lumber is expected to be available in sufficient quantity to get all construction requirements, and adequate supplies should be forthcoming throughout 1946, the War Production Board reports. This prediction is made despite the fact that the general WPB control on construction, or order L-41, has been almost completely removed to permit a large building program to be started at once (*ENR* Aug. 30, vol. p. 213. As a result of the optimistic outlook, WPB order L-335, the general lumber control, has been greatly relaxed and the softwood plywood controls eliminated completely. Moreover, the lumber order may be removed entirely in the next few weeks.

The reason for relaxing the lumber controls at this time is the great reduction that has occurred in lumber demands for military purposes. The war department has already announced a cancellation of orders for over 600,000,000 b. ft. When the large reductions of the Navy, other military organizations and the war industries are added, the total cutback is more than one billion board feet. This large reduction, plus the fact that a month's supply was on hand for military operations when the Japanese war ended, is expected to result in sufficient construction supplies by the end of September.

Local supplies may be tight

However, it is pointed out that for the next few months inadequate supplies of dry lumber in boards and dimension sizes of better grades will be limited in some areas. But in 3 to 6 months a sufficient accumulation should be available in most areas.

The estimated total lumber production for 1945 is 29.5 billion b. ft., which is the lowest total of the war years but much higher than the average annual production for the last prewar decade. When Japan stopped fighting about three-fourths of this production was being used directly or indirectly for war purposes. The military demand has now been reduced to approximately 17 percent, while the rate of production is expected to remain at about the same rate. However, since war orders were generally in car load lots directly from the mills, it will be about 30 days before wholesalers and retailers will have an adequate inventory to meet most needs; when the war ended the lumber industry had on stock less than 6.0 billion b. ft., or only about one-third of the 1941 inventory.

The major relaxation of L-335, which occurred Aug. 22, consisted of appreciably amending Direction 7 to the control and the revocation of all other directions to the order. The effect of amending Direction 7 was to "open-end" L-335.

This relaxation means that any lumber supplier, whether a mill, concentration yard or distributor, may now sell lumber of all types to any purchaser on uncertified and unrated orders, provided that this action does not interfere with the filling of certified and rated orders. Since this latter demand is now only a small percentage of the total production, the amendment of Direction 7 means that suppliers will be permitted to sell large quantities for civilian construction.

Allotments made for the third quarter of the year or until the end of September remain in force, the WPB emphasizes. Also, lumber users qualified to place certified and rated orders to carry out necessary military projects may continue to do so. Such firms, of course, are permitted to obtain lumber on uncertified and unrated orders for civilian construction without charging this lumber against the amounts they have been authorized to receive on rated orders.

Directions 1 through 5 required mills to give preferential treatment to military orders up to specified percentages of their output. As a result of the revocation of these orders, the special controls have been removed on the distribution of West Coast lumber, western pine, California redwood, southern yellow pine, and red and yellow cypress.

Direction 1-a, which was designed to provide Douglas fir and western hemlock boards and dimension lumber for military work, has also been removed. This restriction required the mills to cut 40 percent of their output in 1-in. lumber and 25 percent in 2-in. material.

The movement of western pine and certain heavy hardwoods were controlled by Directions 2-a and 6. The only control remaining on these lumbers are the provisions of Direction 7, and no special authorization is necessary.

Direction 8, which provided some "free" supplies to distributors and permitted self-certified emergency repair orders for lumber, is no longer needed because of the new provisions of Direction 7. Also revoked are Direction 9, restricting the use of certain western softwoods of specific grades for manufacturing purposes, and Direction 12, which provided lumber for privately financed housing construction.

Plywood order also eliminated

The reduction of military demands has also permitted the revocation of the controls on softwood plywood or WPB orders L-150 and L-150a. Before the war ended military requirements were taking 97 percent of the output of softwood plywood. With the defeat of Japan this demand was eliminated almost entirely. As a result, it was possible to remove the plywood orders.

A new $294,000 filtration plant at Adrian, Mich., will begin operating soon on a 24-hr. basis, supplying 1,250,000 gpd. Preliminary filtration and purification tests have been entirely satisfactory, according to H. E. Smith, water board manager. Construction on the plant was begun last April.

Most utility restrictions removed

The Office of War Utilities, War Production Board, Effective Sept. 30 will eliminate orders U-1, U-3 and U-4. These orders are the basic war regulations covering construction of new electric, water, gas and wire communications facilities and providing maintenance, repair and operating supplies priorities for these facilities.

Order U-1 applies to electric, water and gas utilities, U-3 to telephone companies and U-4 to telegraph companies. The amendments bring the three orders into conformity with other WPB orders and regulations being issued to end the AA priorities system at the end of the third quarter.

The amendments also complete the "open ending" of utility construction by removing the provision requiring WPB approval for construction of buildings costing more than $25,000. All restrictions on utility construction other than buildings costing more than $25,000 were removed as a consequence of V-E day. Existing inventory controls for utilities are unchanged by the amendments. After Sept. 30, the utilities will be subject to the general inventory controls then applicable to all industry.

Engineer "Warships" Commissioned For Overseas Duty

What will probably be the last vessels to be commissioned in the three-year program of the Army Engineers to build up a great fleet of dredges and port repair ships adequate for overseas war requirements received their official plaques and the blessing of the top Engineer officers responsible for their construction and the training of their crews at Fort Mifflin, the Engineer Department "navy yard" on the Delaware River near Philadelphia recently. They were the 2,500-ton port repair ship "Arthur Courtland Ely" and the 700 cu. yd. hopper dredge "James F. C. Hyde."

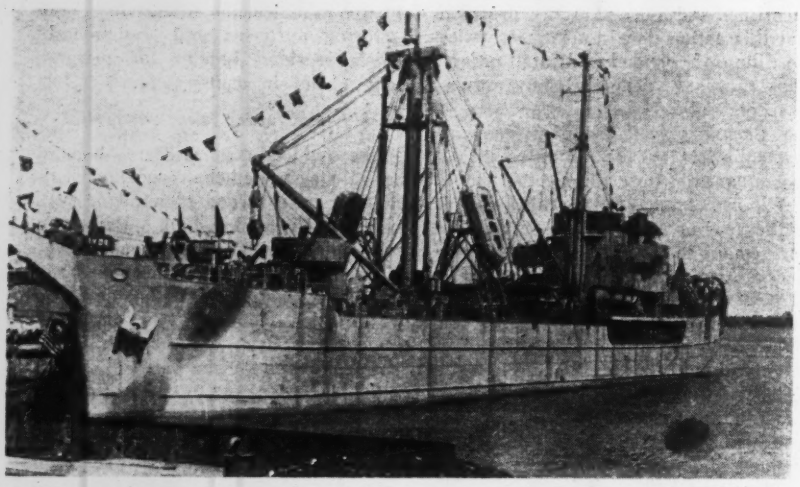
The commissioning ceremonies were in charge of Col. Clarence Renshaw, district engineer, Philadelphia, under which office the ship program has been handled, and the actual commissioning was done by Col. Albert H. Burton, division engineer, North Atlantic Division, New York. Colonel Burton reminded the men of the important jobs that await them in the Pacific where they will be joined by other ships and crews now being deployed from sites of great accomplishments in such European ports as Cherbourg, LeHavre and Antwerp.

Lt. Arthur Courtland Ely, for whom the port repair ship is named, was an officer of an Engineer Special Brigade in the Pacific, killed when he charged a Japanese machine gun. Brig. Gen. James F. C. Hyde, the Engineer officer whose name the dredge carries, was S.O.S. Commander in Central Africa in 1942, and thereafter had an Island Command in the Pacific until he died unexpectedly in 1944 while on leave in the United States.

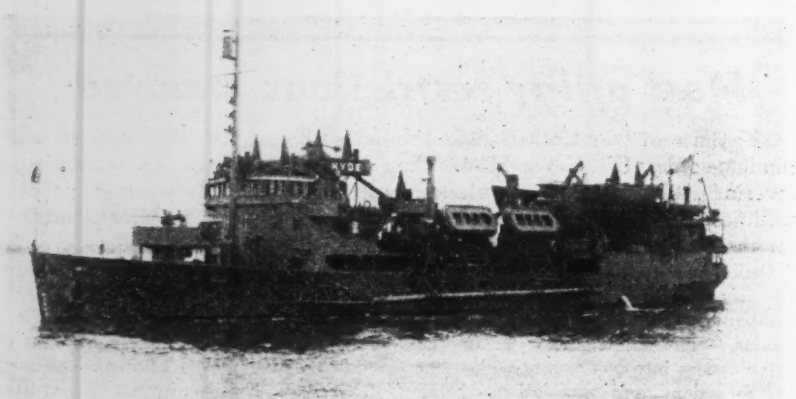
The port repair ships, of which the "Ely" is an example, are great floating workshops planned to be self-sufficient in carrying out salvage missions in repairing or constructing harbor facilities and in rebuilding such equipment as locks, basin gates, cranes, etc. They have a length overall of 269 ft., a normal draft of slightly over 14 ft., and a speed, at normal draft, of 10 knots. The crew consists of ten officers, 60 men, and a Navy armed guard of thirteen.

In addition to machine shops and welding shops, the ships are equipped with all manner of diving apparatus including a decompression chamber. They carry on their bow a 40-ton cathead, and in addition are equipped with numerous booms, largest of which is one of 50-ton capacity stepped forward of the foremast and serving a hatch opening 22x24 ft. giving access to the interior of the ship. Two 10-ton cargo booms are also stepped on this mast. The vessels are of all-welded construction.

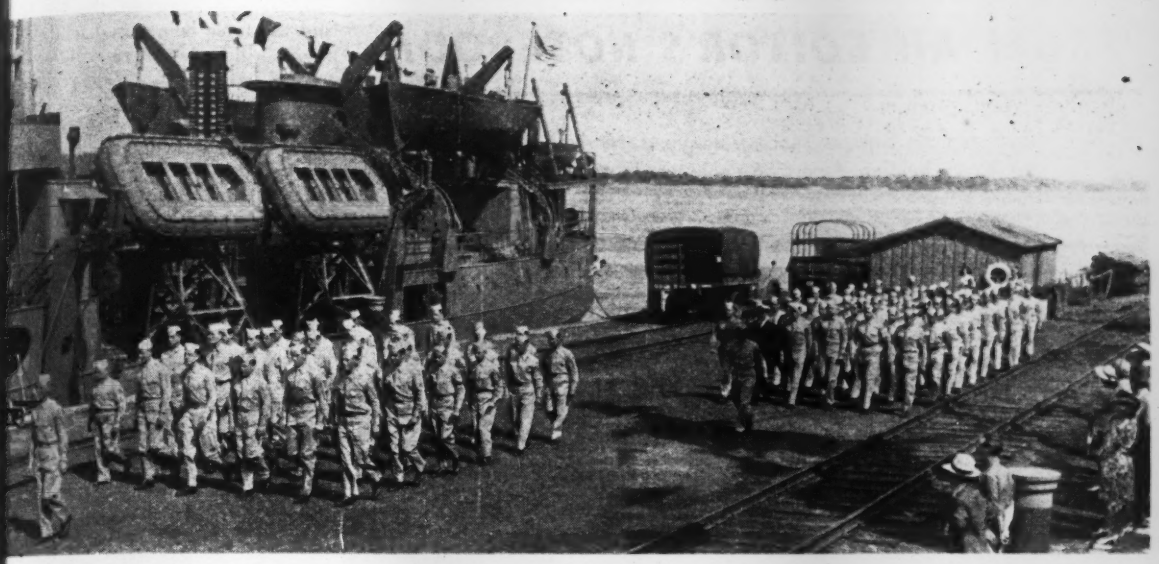
The dredge "Hyde" is of the new ocean-going hopper-type designed to be used for shoal water dredging, such as was required at Antwerp, for example. The overall length of these vessels is 216 ft., and they have a light draft of 8 ft. and a loaded draft of 12½ ft. Loaded they have a speed of about 11 knots. They are powered with two 12-cylinder two-cycle diesel engines for propulsion and pumping. The 420-hp. dredge pump operates an 18-in. suction drag pipe each side of the ship.



Port Repair Ship "Ely" on her commissioning day at the U. S. Engineer "navy yard" at Fort Mifflin on the Delaware River near Philadelphia. Similar Engineer vessels were attached to the Port Construction and Repair Groups that reopened European harbors.



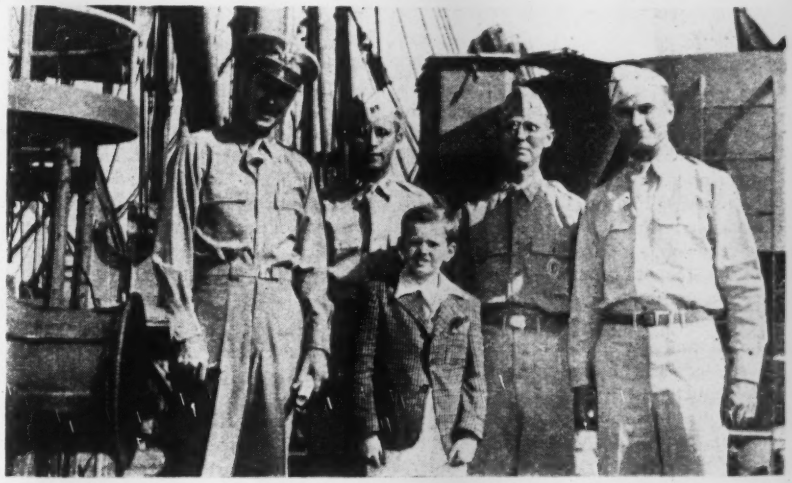
Engineer Dredge "Hyde", one of a type built for operating in shoal water to clear the way for reopening of war-wrecked harbors or for starting entirely new ones. One of the 18-in. suction pipes that fills its hoppers with 700 cu. yd. of material in 36 min. is shown in "underway position".



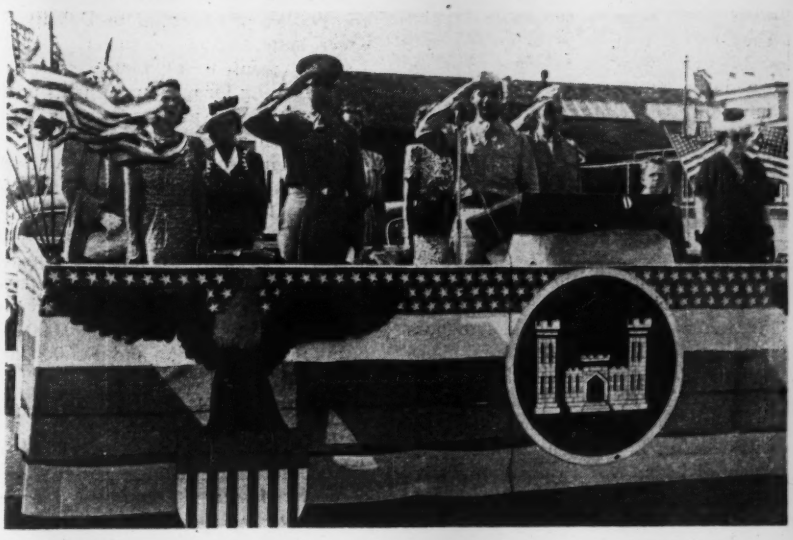
rews start for reviewing stand where commissioning is to take place. At left, Capt. J. T. Williams leads his 2867th ngineer Dredge Crew, while at the right is Capt. Royal P. Pihl at the head of the 2884th Engineer Special Detach-ent, which will man the port repair ship.

d discharges through a 20-in. line nning the full length of eight hoppers the vessel's hull. The pump can take oard a full load in 36 minutes.

Although these dredges are relatively all compared with some other Engi-er dredges, the 2,500-yd. "Chester L. arding", for example, which was tied adjacent to the "Hyde" during the mmissioning ceremonies resplendent E.T.O. ribbons painted on her stacks, ese small dredges have been indispen-ble in opening up harbors in the early ges of a campaign. With the build-g program now complete, there is be-ved to be an adequate number of e vessels available for the expected ge volume of work in the Pacific.



incipals (right above) at the commis-ning, left to right: Col. Albert H. rton, Division Engineer, North Atlan-Division; Capt. Royal P. Pihl of the ly"; Capt. J. T. Williams of the yde"; and Col. Clarence Renshaw, trict Engineer, Philadelphia Engineer trict. In the center is Arthur Court-d Ely, Jr., for whose father the port air ship is named.



mmissioning ends (at right) with r Spangled Banner. On the reviewing nd in front row, left to right, are s. James F. C. Hyde, Colonel Burton, olonel Renshaw and Mrs. Edna P. Ely, ther of Lt. Ely for whom the port air ship is named, with her grand-, Arthur Courtland Ely, Jr. The of-r behind Colonel Renshaw is Captain de, son of General Hyde, whose me the dredge carries.

FROM AN EDITOR'S NOTEBOOK

Dr. Karl Imhoff, famous German sanitary engineer, survived the Nazi debacle and is now helping American engineers in occupied areas.

Correspondence from several sources abroad brings the news that Dr. Karl Imhoff, German consulting engineer and an internationally famous authority on sewage treatment methods, has survived the Nazi debacle and, in fact, has been aiding the Allied Military Government in connection with sanitary engineering matters in occupied Germany.

Inventor of the Imhoff tank, a dual-compartment sedimentation unit that won wide popularity for sewage disposal plants in the United States for at least two decades following its introduction in 1906, Dr. Imhoff was a frequent visitor to this country. Opposed to Nazism from its very inception, he was eventually dismissed from his state post as chief engineer of the Ruhrverband, a river basin authority.

Visited U. S. In 1936

On his last visit to this country, in 1936, he confided that the Nazis had permitted him to engage in private engineering practice, probably because of his professional qualifications. There is reason to believe that his findings on the recovery and use of sludge digestor gas for the operation of internal combustion engines played an important role in maintaining the operation of municipal and commercial vehicles while Germany was hoarding gasoline for other purposes.

During the last few years virtually nothing was heard concerning Dr. Imhoff. Since the occupation of Germany, however, a number of American engineers have been in contact with him. They report that he is in good health and is living with his wife and 13-yr. old son in a cottage on Ammer See at Schondorf (near Munich), Bavaria. He has expressed the hope that he will soon be able to renew his contacts in the United States.

Engineers who saw Imhoff

Among those reported to have talked with Dr. Imhoff were the following members of a technical mission now inspecting water supply and sewage disposal installations in Germany: Arthur Sheridan, commissioner of public works, Bronx, N. Y.; Anthony Fisher, research engineer, The Dorr Co., Inc., New York City; Arthur E. Gorman, director of the water division, War Production Board; Lt. Col. Joseph Gilbert, Sanitary Corps; and Maj. M. W. Tatlock of the Provost Marshal General's office.

It is also known that Dr. Imhoff was visited by Capt. Herbert Moore, Sanitary Corps engineer from Milwaukee who is stationed in Salzburg and by Capt. D. S. Abell, Sanitary Corps, formerly chief engineer of the Alabama state department of health.

Was a bridge consultant

Dr. Imhoff began his engineering career as a bridge designer, and conducted a consulting business in Mannheim, Germany, from 1900-03. When he patented the Imhoff tank principle in 1906 he became chief engineer for the Essen Sewerage and Drainage District.

Leaving this post in 1914 he became chief engineer of the Ruhrverband where he later installed works to provide for pollution control and repeated use of Ruhr River water for industrial processing purposes (*ENR* May 28, 1931, p. 883). His last article to appear in this journal (Jan. 2, 1936, p. 8) dealt with an appraisal of sewage disposal practice in England as related to developments in the United States.—E.J.C.

• • •

Big Texas road building plans get green light

The Texas Highway Department has $30,000,000 for early expenditure and $65,000,000 worth of roads planned in detail for whenever labor and materials are available, according to DeWitt C. Greer, state highway engineer.

Greer pointed out that Texas has been planning for many months its post-war construction program, and now is ready to go ahead. The $30,000,000 is invested in short term government bonds, and the state expects federal matching funds to be provided.

For the next three years, the Texas Highway Department plans to spend $173,000,000 on road improvements. This includes $86,000,000 to expand the federal highway system; $60,000,000 for farm-to-market roads; and $27,000,000 on urban routes.

Greer said the application of this program will be limited only by the availability of labor and the release of scarce materials. Approximately 1,500 highway department employees were in military service when the war ended and the force being used totaled about 7,000, which compares with a pre-war normal of 8,000 to 10,000 regular full-time workers.

The Texas Highway Department recently announced plans to train apprentice workers, to be paid partly from federal funds. They will work at jobs such as rodmen, chainmen, concrete and asphalt inspectors.

The State Highway Department anticipates that county officials also will launch extensive roadbuilding projects early in the postwar period.

• • •

Million acres of land to be irrigated

Land-owners in the Columbia Basin Irrigation District of eastern Washington have approved, by a vote of 2,3[illegible] to 52, contracts for repayment to the federal government of part of the cost of irrigating a million acres of land.

The vote makes possible the construction of the $280,000,000 irrigation works, contingent on the appropriation of funds by Congress.

Land-owners agree to repay approximately $90,000,000 of the cost over a 40-year period, with individual assessments of not more than $85 an acre. Power from Grand Coulee Dam will pay the remainder of the cost. Each farmer will have to build his own farm canal system.

The project, to be constructed by the U. S. Bureau of Reclamation, calls for four new dams, more than 4,000 miles of canals, 66 siphons to carry water across valleys and coulees, several miles of tunnels and the world's greatest pumping plant at Grand Coulee Dam, powered by the largest electric motors to lift the water 280 ft. from Columbia River. Each of these 12 pumps will have a capacity of 12,000 gps.

The largest dam for the project would be the 15,000-ft.-long Potholes Dam in the central portion of the basin.

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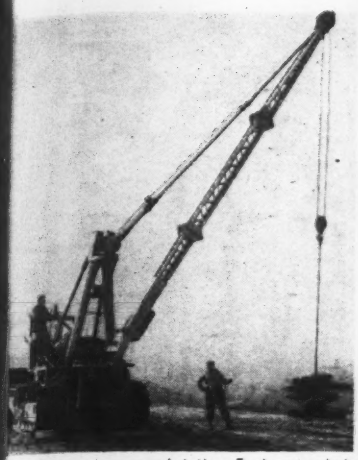
New inspection tunnel opened at Niagara Falls

A new public inspection tunnel and gallery beneath Niagara Falls was opened officially on Aug. 4 by Lands Minister Charles Daly of Ontario. It was the first opening to the public of inspection facilities at the falls since August, 1939, when war restrictions went into effect. The new tunnel works were designed by H. G. Acres and consulting engineers of Niagara Falls, Ont., and were built by the Roberts Construction Co., also of Niagara Falls.



Aviation Engineers photo

Tractor-mounted crane

Army Engineers have a revolving crane, made up for attachment on a large tractor, that will lift 6 tons at 12-ft. radius. Boom length can be varied from 20 to 35 ft.

The crane unit is made up in a kit that can be attached by three men in 4 to 5 hours. When semi-permanent fittings are not removed the crane unit can be installed in 45 min. and removed in 25 min.

The new outfit is said to be most useful for cargo handling and where travel over rough terrain is necessary. It was developed by the Engineer Board at Ft. Belvoir in cooperation with the Hyster Co.

Billion dollar, 6-year transit program for N.Y.C. Board of Transportation

New 2nd Ave., and 72nd St. subways, various extensions and improvements to present underground and surface lines proposed

The outlay of a billion dollars in the next six years for the extension and improvement of the transit facilities of New York City is proposed in a program submitted by the Board of Transportation to the City Planning Commission on Aug. 23.

Included in the proposals is $38,715,000 for modernization of the street car and bus lines in the Borough of Brooklyn, but the principal part of the program has to do with the construction of new subway facilities, especially a $344,110,000 subway under Second Avenue, Manhattan, with an extension into the Bronx. It is estimated that it will take five years to build this subway.

All items in the program, except those dealing with the street car and bus lines, have been listed in previous capital budget proposals by the Board of Transportation. However, the estimated costs are higher than formerly because of expected increases in the cost of labor and materials.

Old and new projects

In its six-year program the Board of Transportation asks for funds to complete projects held up by the war, in addition to $220,000,000 required for additional facilities for lines now in operation. These facilities include new cars, power-plant modernization and platform extensions, estimated to cost $183,000,000; a $4,800,000 central office building; $1,000,000 for additional yard facilities in Manhattan and Queens; $18,800,000 for the Fulton Street extension in Brooklyn, and $12,540,000 to complete the Culver line in Brooklyn.

On its six-year program the Board of Transportation listed such projects as the proposed Seventy-second Street subway in Manhattan, including a tunnel under the East River linking the new line to Jackson Heights, Queens, via Columbus Circle. The estimated cost of the project is $102,350,000. Two other projects, costing $10,580,000 and $12,590,000, respectively, would link the Seventy-second Street line to other points in Queens.

Lines to airfields planned

The six-year list also includes a $12,080,000 extension of the Astoria subway line to La Guardia Field and a $21,520,000 extension of the Van Wyck Boulevard line in Queens to the edge of the Idlewild Airport. Also on the list are a new $59,590,000 storage yard and subway connection in Queens and a $63,250,000 storage yard and subway connection in Brooklyn. Also listed is the proposed $50,610,000 Staten Island transit tunnel between Brooklyn and New Brighton.

A spokesman for the Board of Transportation expressed the hope that the unexpectedly early ending of the war would make it possible for the planning agency to expedite some of the more pressing items on the program by recommending the necessary appropriations in the 1946 capital budget.

BRIEF NEWS

Immediate use by the city of thousands of tons of steel plant slag piled high on the south side of Shore Drive, Cleveland, Ohio, for lake front improvements has been demanded by Proctor Noyes, coordinator of postwar public works. Meeting with Mayor Burke, Law Director Lee Howley and Service Director Samuel F. David, Mr. Noyes asked that the slag be moved to the north side of the highway to make new land. He suggested that the shifting of the material be done by building a tunnel under Shore Drive so that there would be no interference with traffic.

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The Hartford, Conn., Flood Commission's first report since 1936 shows $6,000,000 must be spent before the flood control project is completed. A total of $16,000,000 has been spent. Major projects include North Meadows highway at an estimated cost of $3,950,000 and the Morgan Street cloverleaf approach to the Buckeley Bridge to cost $1,500,000.

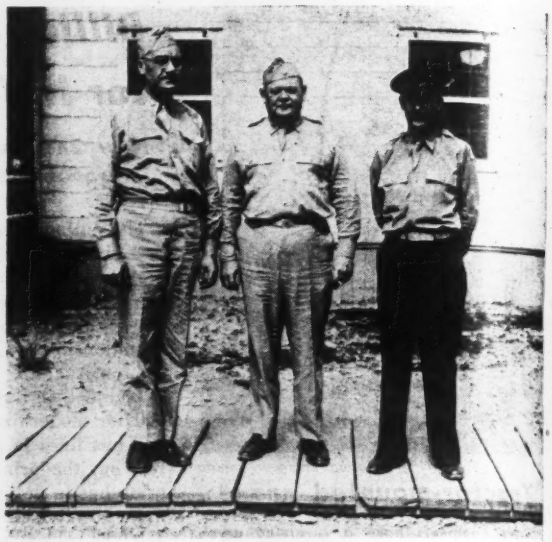
Revenue from the concrete pontoon toll bridge across Lake Washington at Seattle, Wash., last year reached $593,179, a new high in the bridge's five-year operation, state officials have announced. The total revenue of the bridge has been $2,507,288. Its cost was $9,816,049.

The Great Lakes-Cincinnati-Charleston Super-Military Highway Association has been organized in Knoxville, Tenn., to promote postwar construction of an express highway from Toledo, Ohio, to Charleston, S. C. Tentative plans call for construction of all or parts of the highway as a toll road under a proposal now before Congress that permits financing of national highways by revenue bond issues.

The Mexico City airport will be enlarged to receive super-airliners, according to Pedro Martinez Tornell, department of public works. He said new terminal facilities and longer landing strips will be constructed. Improvements will be made also on airports at Monterrey, Merida, Ixtepec, Campeche, and Chiapas. Approximately $5,000,000 will be spent.

The North Carolina Highway and Public Works Commission has approved maintenance budgets of $5,500,000 and $10,000,000 for state highways and county roads, respectively, during 1945-46. It also approved a $5,000,000 allocation for the improvement of both state and county roads, $5,000,000 betterment funds for county roads alone, and an appropriation of $1,000,000 for highways in municipalities.

MAJ. GEN. DAVID M'COACH, JR., commanding general, Sixth Service Command, (left) appears unconcerned while being introduced by COL. H. J. WOODBURY, district engineer, U. S. Engineer Office, Chicago, at the 170th anniversary celebration of the establishment of the Corps of Engineers, held in Chicago recently. Dwight Green, governor of Illinois is in the background.



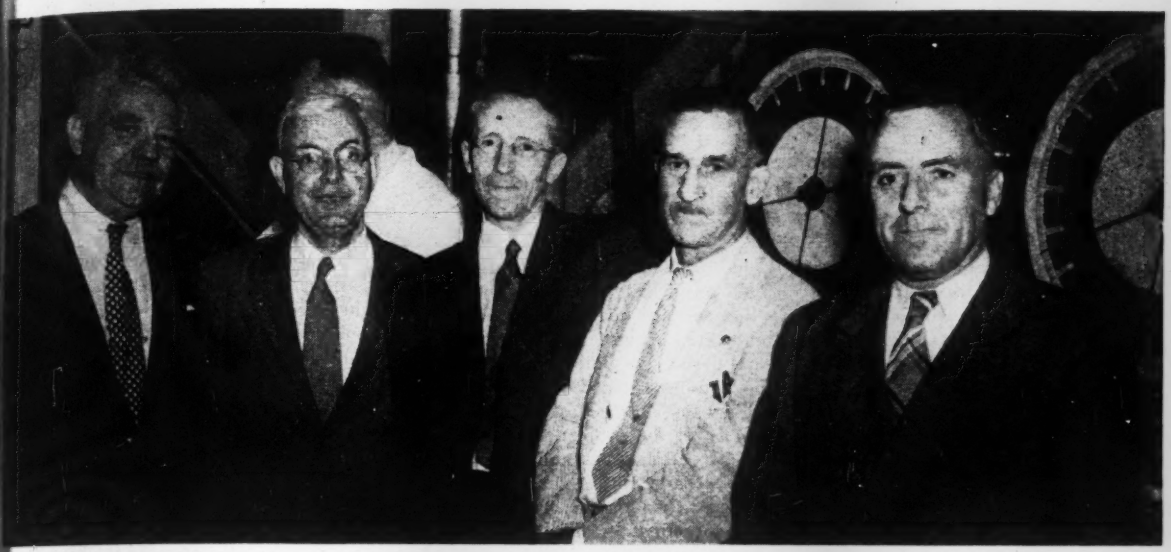
Three army engineers responsible for the efficient demolition of Camp Hale, Colo., are LT. COL. C. S. STAHL, construction engineer, Missouri River Division; MAJ. DON A. M'KINNON, construction engineer, Denver District; and CAPT. LEON D. HOWARD, resident engineer on the project. An article describing this project was published in the August 23 issue of ENR.

MEN AT WORK

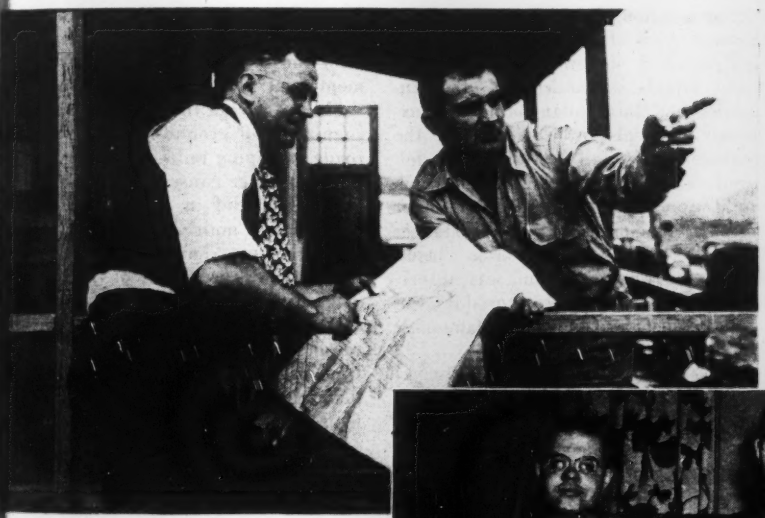
This summer PAUL LANHAM, now in charge of operation and maintenance, water department, District of Columbia, will complete 40 years of service with that department. He joined the division in June, 1905.

LT. COL. WM. HOLLAND, Vicksburg district engineer office, and K. R. (CY) YOUNG, U. S. area engineer of Monroe, La., stand on the levee at Monroe, La., with the Ouchita floodwaters lapping the top of the embankment. Cy Young, a veteran of many a flood battle, had to build a mudbox down a Monroe main street to keep the river out of a gap in the concrete floodwall.

An old flood fighter, BRIG. GEN. MAX TYLER, president, Mississippi River Commission, pauses on top of a revetted section of the Morganza Floodway fuseplug levee during the spring high water.



Five key engineers in activities in the District of Columbia section, American Society of Civil Engineers, inspect the Timber Engineering Co. laboratories in Washington. Four of the men also hold key positions in the federal government. Left to right they are: H. H. MARSH, past president of the section and consulting engineer; B. E. JONES, this year's president and hydraulic engineer, U. S. Geological Survey; CLIFFORD A. BETTS, past president of the section and civil engineer, U. S. Forest Service; FRANK WEAVER, vice-president of the section and associate chief of the bureau of water power, Federal Power Commission; and GAIL HATHAWAY, another past president and head engineer in the Office of the Chief of Engineers, U. S. Army.



L. WESCOTT, assistant chief engineer and R. TRUZZIE, superintendent for Harrison Construction Co., discuss plans for the Kanawha Airport project near Charleston, W. Va.

Newly elected officers of the North Dakota Society of Professional Engineers are, left to right: JOHN B. JARDINE, manager, Concrete Sectional Culvert Co., vice-president; T. C. LAUSTER, director, Division of Sanitary Engineering of the State Department of Health, president; and GEORGE TESKEY, right-of-way engineer, North Dakota State Highway Department, secretary-treasurer.

Blame not definitely fixed in report by investigators of Cleveland gas fire

Lack of applicable codes, choice of type and of steel for cylindrical tank cited as possible factors in disaster

A report by consultants studying the Cleveland gas blast and fire of last fall blames both the public and gas company authorities for lack of safeguards that permitted extensive loss of life and property.

On the afternoon of Oct. 20, 1944, almost without warning, the largest of the East Ohio Gas Company's liquid gas storage tanks, at East 55th St. near Cleveland's lake front, burst into flames. The fire spread with uncontrollable fury, damaging the plant, the immediate property, and the neighboring areas to an amount variously estimated at from six to eight million dollars. Death total was some 130 lives. (*ENR* Nov. 2, p. 535, Nov. 16, p. 604, and Dec. 14, p. 734, 1944).

A technical investigation ordered by the mayor was conducted by George E. Barnes, head of the department of civil engineering, Matthew M. Braideth, professor of industrial and sanitary chemistry, and Kenneth H. Donaldson, head of the department of metallurgical engineering, all of the Case School of Applied Science. The full board of inquiry included others, but the report is that of the technical consultants named.

According to the report, ". . . the catastrophe occurred because of some deficiency or failure due to causes unknown, in the design, construction or operation of this unique process for the liquefication of natural gas and storage at a temperature of 260 deg. F. below zero. . : ." It was the only plant of its kind in the world and was considered a great step forward in the technical development of the natural gas industry.

The gas had been liquefied for storage close to point of need to be ready to be put into mains supplying industrial and domestic requirements, whenever cold weather might overtax the capacity of the incoming pipe lines. In liquid state, the gas occupies only 1/640 of its normal volume and weighs less than water. The equivalent of 100,000,000 cu.ft. of gas was in the cylindrical tank, Fig. 2, that failed first, which is described as a toro-segmental structure, and an additional 50,000,000 cu.ft. was in the adjacent spherical tank which failed from the heat. According to the report, some 260 billion Btu. was dissipated in two hours. Two additional 50,000,000 cu.ft. storage tanks, filled to capacity, withstood the fire.

Conclusions reached by the consultants are, in part, as follows: "Necessary permits to build were granted by the public authorities under existing ordinances and codes. Owing to the novelty of the project, few codes were directly applicable, and some permits were of a negative character, in that there was no logical basis for refusal. The investigation discloses no single element in the situation which, taken alone, would account for the disaster. It does, however, disclose a number of factors which, taken in combination or in accidental coincidence, might account for the disaster. . . .

Location poorly chosen

"The location of the plant was poorly chosen in view of the surroundings, and the potential destructiveness of the stored liquids. Practices of other industries handling inflammable and explosive materials in providing for the contingency of failure, were not followed or imitated to the extent which would appear to be warranted under the existing conditions. . . . Distances between storage tanks was insufficient, the diking system was utterly inadequate, insufficient provision was made against the escape of inflammable liquids and gas into the sewer . . .

"It is clear that tank A (Fig. 1) first failed and caused the failure of tank C whose supporting columns buckled with the heat . . . The selection of the cylindrical type of tank for storage unit A, as contrasted with the spherical type for units C, D and E, was unfortunate, considering the materials used in its construction. The spherical type cushioned the brittle inner shell against shock and vibration whereas the cylindrical type lacked this desirable feature.

"The design of the work incorporated certain materials whose suitability for the service intended was not, in the opinion of the consultants, definitely established. The principal item in question is the use of the 3½ percent nickel steel for the inner shell and other structural elements in tank A which is exposed to extreme low temperatures under load. . . .

Welded patch found sound

"The fragmentation of the tank indicates that its failure is of the type that would accompany either shock on a very brittle material or a violent internal explosion on any material. . . . The welded patch which was put on the bottom of the inner shell of tank A to repair a break, which occurred when the tank was first cooled down during filling operations, was sound after the disaster, and was not an element contributing to the failure. . . .

"In the design there was no apparent cognizance of ground tremors from railroads, stamping mills, machinery in the plant or other causes of possible vibration, which did in fact exist in measurable and noticeable degree. Field measurements, however, indicate that these tremors were not of the order of magnitude to result in certain failure of the structures, except by accidental resonance . . . It is concluded that tremors about the plant cannot be blamed for the failure though their effect may have been added to other

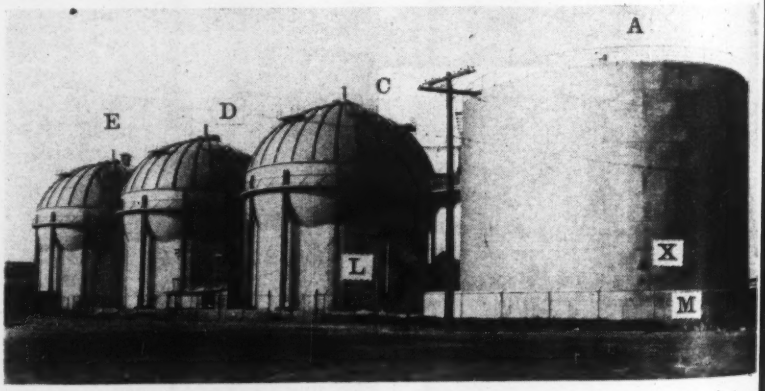


Fig. 1. Heat from burning gases from the toro-segmental tank A caused failure of tank C while tanks D and E survived the fire, though filled with liquid gas. The X marks the spot where vapors were seen to emerge before taking fire. The letter M designates a dike wall and L a curtain wall around the tanks, added after the original construction.

causes. The concrete foundation mat and substructure under tank A did not overload the soil and evidenced no significant settlement or tilting either before or after the fire.

"Analysis of the stresses in tank A indicate that the designers held the primary stresses low for safety. However, they submitted no calculations to show that they had analyzed secondary stresses (stresses due to differential deflections or distortions of the structural elements under load). Analysis of these secondary stresses by the consultants indicate some of them to be unduly high; as in the lower ring girder which supports the wall of the inner shell, where total stress may have been much higher than ordinarily allowed."

Quoting further from the report: "It is to be emphasized that, throughout all of the testimony which was taken and throughout the entire investigation, there has been every evidence of good faith and diligence on the part of all persons in organizations who have participated in the development and execution of the project."

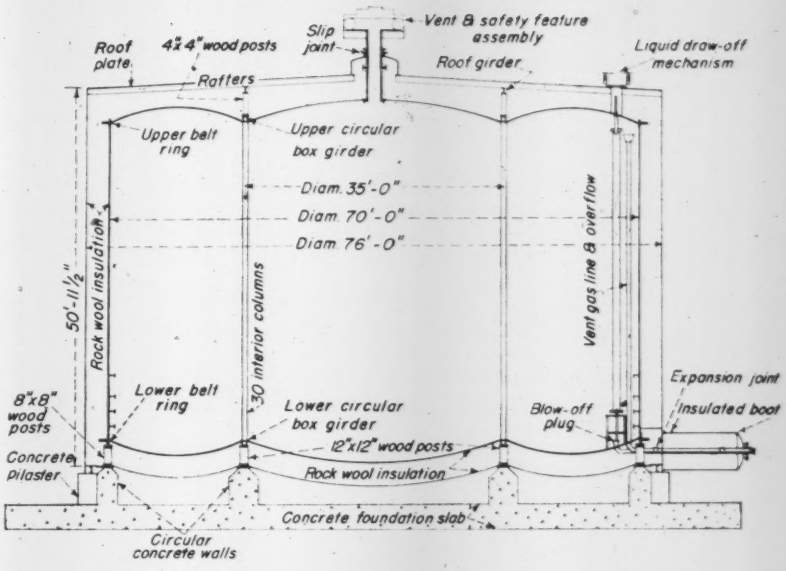


Fig. 2. Section through cylindrical toro-segmental tank which held the equivalent of 100,000,000 cu.ft. of gas at the time of the fire.

Turkish engineers end highway inspection tour

Vecdi Diker, engineer of the highway division of the Ministry of Public Works, Ankara, Turkey, recently completed a four months tour of inspection of highways in this country and is about to fly back to Turkey. Mr. Diker was accompanied on this trip by three other engineers, Messrs. Veligi Ekesan, Orhan Koraltan and Nejat Tokay. Included in their trip were visits to the plants of manufacturers of construction equipment to familiarize themselves with new developments. They also made a study of research laboratory set-ups and contractors' plants. Mr. Diker is no stranger to this country and its methods of roadbuilding, having studied engineering at the University of Missouri. Mr. Diker's mission spent about four months in the United States, two months of which were used to make a thorough survey of the Federal Works Agency and the Public Roads Administration.

In cooperation with the Public Roads Administration, Mr. Diker visited state highway departments on the Atlantic Seaboard, in the Midwest and on the Pacific Coast to learn of developments in this country in recent years.

Turkey expects to build 25,000 km. of new road on its primary road system within the next ten years, and within the next 20 years expects to build or rebuild about 150,000 km., including country roads, and farm to market roads of its primary and secondary systems. The total expenditure is estimated to be in the neighborhood of one billion dollars.

This will call for an expansion of the highway division of the Ministry of Public Works and for the development of new techniques involving the use of much more construction equipment than has been the practice in the past in Turkey. As a consequence, Mr. Diker devoted much of his attention to studying the organization of our Public Roads Administration and of the state highway departments. Present plans are to engage some highway engineers from this country to assist in this expansion, and it is probable that engineers from Turkey will be sent to this country for training, especially in the use of construction equipment. Five thousand students are studying engineering in this country.

Previous to the war, Turkey did most of its highway work by the contract system. In the war days occasionally they found it necessary to resort to force account, but the postwar work will be done largely by contract. The Ministry of Public Works hopes to interest American contractors in this work. An ideal arrangement, Mr. Diker states, would be for an American firm to associate itself with one of the large Turkish contracting firms in this work, the American firm putting its capital into the venture in the form of construction equipment. This would minimize the effect of the operation on Turkey's balance of trade with this country.

Mr. Diker states that the Ministry of Public Works plans to build much of the new primary system by stage construction. The system will be laid out with good grades and alignment, but the initial surfacing will be chiefly some type of stabilized soil, using sand, clay or gravel. There also will be some penetration macadam in the more populous regions and some highways surfaced with rock asphalt, of which Turkey has an ample supply. A few concrete roads will be built around large cities.

The Ministry of Public Works is made up of five main divisions, highway, railways (including ports), water supply and irrigation, building, and electrification. Twenty hydro-electric stations are to be built, each costing around five to ten million dollars, similar to the TVA setup in this country. The government-owned railway system expects to build 6,000 km. of new railway lines within the next ten or twenty years, beginning with about 200 km. a year at the start and increasing to around 500 km. a year. From six to eight ports are to be built or modernized under this program of the railway division, involving a cost of about $150,000,000

Asked whether there were opportunities for consulting engineers as well as contractors in Turkey, Mr. Diker replied that there would be opportunities for men of recognized standing. He added that the Turkish government will do everything in its power to facilitate the work of engineering and contracting concerns who would like to come to Turkey. Interested parties should seek additional information from the Turkish Commercial Council office, 20 Exchange Place, New York.

MEN AND JOBS

Promotion of **Burton S. Grant** to assistant chief engineer of water works for the Los Angeles Department of Water and Power was announced recently. He succeeds **Laurance E. Goit**, newly appointed head of the municipal water system. A graduate in civil engineering from the University of California at Los Angeles, he has been an employee of the department since 1925 and has been office engineer, personnel officer of the city's water system and assistant engineer of the aqueduct division before being placed in charge of the division in 1940.

Tech. Sgt. E. L. Shaffer, believed to be the first Jacksonville, Fla., man released from the armed services under the point system, qualified quickly as an engineering aid in the survey department of the United States Engineer Office in Jacksonville. He had served with the Fifth Army Combat Engineers and saw action in North Africa and Italy.

Verdon L. Dix, first lieutenant, U. S. Public Health Service, has been assigned as area engineer in charge of malaria control work in Shelby County, Tenn. Before being commissioned in the U.S.P.H.S., Lt. Dix was associated with the United Engineers and Constructors, Inc., of Philadelphia, Pa., as a structural engineer.

State Highway Director Robin Swift of Alabama has been granted an indefinite leave of absence and his assistant, **Ed Rogers**, has been appointed acting director, Gov. Chauncey Sparks, announced. Mr. Swift asked for a leave to resume management of the Swift-Hunter Lumber Co. at Atmore.

Albert R. Bell, of New Bern, N. C., assistant director of schools of the Engineer Battalion at Camp Lejeune, N. C., has been promoted to captain. A graduate of the North Carolina State College School of Engineering, he was a civil engineer with the FWA at Raleigh, N. C., prior to joining the Marine Corps in August, 1942. He participated in the Roi-Namur, Saipan and Tinian engagements as executive officer of an engineer assault company, and returned to this country last February after 15 months overseas.

Col. Robert F. Seedlock, civil engineer and commanding officer of the Burma Road Engineers, has returned to China after a 45-day furlough in Savannah, Ga., recently. He had been overseas for about two years. Colonel Seedlock is a West Point graduate and received a master's degree in civil engineering from the Massachusetts Institute of Technology.

Max S. Campbell, formerly chief engineer for the Washington state department of health, has become associated with the H. D. Fowler Co. of Seattle, Wash., waterworks supply firm.

E. C. McEachern has been appointed city engineer at Prince Rupert, B. C., succeeding **George S. Hanes.** A graduate of the University of Saskatchewan, he is at present assistant engineer for the International Salmon Fisheries Commission, and is working on the Hell Gate project.

Independence, Kan., has employed **George M. March** of Lawrence as city manager. Mr. March is an associate engineer of the Kansas board of health.

Abolishment of the office of traffic and safety engineer in the New Mexico Highway Department has been announced. It was held by **Clyde O. Faulk** with the department for 25 years. **W. R. Eccles**, former Deming district engineer, succeeds **Guy Mayes** as Albuquerque district engineer. Replacing Mr. Eccles at Deming is **Tom Card**, former construction division assistant. **Frank Hawley**, who was district engineer at Las Vegas, has been appointed assistant district engineer at Albuquerque and is being succeeded by **Charles Johnstone. William B. Catchings** succeeds Mr. Johnstone as state maintenance engineer.

Carawan Nelson, principal engineer with the U. S. District Engineers Office in Jacksonville, Fla., has retired after more than 40 years in the service, having begun in 1903 with the Mobile, Ala., district. He was transferred to the Jacksonville district in 1930. Since then Mr. Nelson has been in charge of the Okeechobee Project, first in the district office to formulate and develop designs, plans and specifications, and to direct the levee and control works system. Later, he was stationed at Clewiston, Fla., as the engineer in charge of maintenance, operations and new construction.

Promotion of **Ralph Lowry** to assistant chief engineer of the Bureau of Reclamation with headquarters in Denver, Colo., and appointment of **Irving K. Harris** to succeed Mr. Lowry as acting construction engineer at Shasta Dam in California have been announced.. Mr. Lowry, who directed construction of Shasta and Keswick Dams of the Central Valley Project, will work under **Walker R. Young**, who formerly was in charge of Shasta Dam operations at Sacramento, Calif. When both men previously had worked on Boulder Dam, Mr. Young had been in charge of construction and Mr. Lowry was his assistant.

Mr. Harris, who until recently was power director at Boulder Dam, will be in charge of operation and equipment at the Shasta power plant and the construction of transmission lines. Before joining the reclamation service in 1909, he was associated with a utility company in southern California. From 1917 to 1933 he was a consulting engineer in Los Angeles after being engineer in charge of the power division of the Salt River Project in Arizona.

Adolph J. Ackerman has resigned his position as director of engineering at Dravo Corp., Pittsburgh, Pa., and will engage in hydroelectric development work in South America. Although in recent years and particularly during the war, he has been engaged in heavy construction work and shipbuilding, the present step marks his return to the field of water power engineering in which he has had exceptionally broad training and experience, beginning as a student of Daniel W. Mead at the University of Wisconsin. His experience includes employment by Fargo Engineering Co., Stone & Webster Inc., Aluminum Co. of America, and Tennessee Valley Authority.

Charles Chandler, Yadkinville, N. C., retired recently as superintendent of the Southern Railway System at Sheffield, Ala., being succeeded by **W. F. Cooper**, formerly at Atlanta, Ga.

Emblems and certificates for meritorious service were presented recently to four engineers by **Col. A. B. Jones**, district engineer at Jacksonville, Fla. The awards were given to **L. H. Cobb, E. M. Hinshaw, Wade H. Slappey**, and **Kenneth L. Warriner.**

ENGINEERING SCHOOL NEWS

James Creese, vice president of Stevens Institute of Technology since 1928, has been elected the sixth president of Drexel Institute of Technology in Philadelphia, Pa., A. J. Drexel Paul, president of the Drexel board of trustees, has announced. Dr. Creese, who is 49, will assume his new duties on Oct. 1.

Since the resignation of President George Peters Rea about a year ago, Dr. Robert C. Disque, Dean of Engineering, has been acting president.

Before going to Stevens Institute, Dr. Creese was associated for several years with the American Scandinavian Foundation. He is chairman of the executive board of the American Association for Adult Education and has made a number of surveys of the extramural responsibilities of colleges and universities, and appraisals of educational projects in engineering.

At Stevens Institute Dr. Creese's special interests included the expansion of work in the humanities as part of the engineering curriculum; the development on the campus of dormitories for students, and residences for the faculty; the provision of funds for special research projects; fostering the public relations program of the college; establishment of the Stevens War Industries Training School; and the institution and operation at the Stevens Engineering Camp (acquired at Johnsonburg, N. J. in 1930) of an annual session for the guidance of boys of high school age and of another session for engineering graduates to permit study of economic problems related to engineering.

Lieut. Col. Thomas Hayhurst Evans, formerly with the Corps of Engineers, A.U.S., stationed in Washington, D. C., has been released from active duty to take over the Department of Civil Engineering at the Georgia School of Technology.

C. D. Williams, professor of structural engineering and head of the department at Fenn College, Cleveland, Ohio, has been appointed acting head of the department of civil engineering at the University of Florida, Gainesville, effective Sept. 1.

During the war Mr. Williams spent a leave of absence as supervisor of stress engineers in charge of the structures group on the B 29 at the Fisher Cleveland Plant No. 2, and five months as assistant supervising engineer with the J. E. Greiner Co. of Baltimore, Md.

Part of the $12,000,000 Ajax munitions plant at Pickering 20 miles east of Toronto, Ont., is being acquired by the University of Toronto for use in the instruction of first year engineering and science students, in view of the phenomenal numbers anticipated from demobilized service personnel. The plant on Lake Ontario was built by Defense Industries Limited. It includes dormitory and hospital accommodations and can be readily converted for temporary university use. It is expected that at least 1500 students will be accommodated there early in 1946.

A million-pound universal testing machine used by The Port of New York Authority to test cable and girders for the George Washington and Bayonne bridges, and no longer required by the agency, is being transferred to Rutgers University, New Brunswick, N. J., it is revealed by Vice-Chairman Joseph M. Byrne, who explains that it had become necessary to remove the machine due to the recent disposal of the Port Authority laboratory building which has housed it in Jersey City. "The machine was designed for the specific purpose of testing strengths of bridge girders, and we no longer have use for it," Mr. Byrne declared. "Our Chief Engineer, J. C. Evans, advised the commission that it would be of real benefit to the general community if the machine could be transferred to a nearby university where it could be made available to students of engineering and to public agencies, as well as to industries requiring such testing service."

Accepting the machine for Rutgers University, which was recently designated as the state university of New Jersey, Dean Parker H. Daggett of the College of Engineering said: "Our engineering experiment station has been doing a great deal of testing and development work for New Jersey industry. None of our machines is designed for the testing of columns and we had had many requests from the industries of the state for tests of this sort, which we have been unable to undertake. We anticipate that the demand on us for testing services by industry as well as the state departments will become increasingly urgent. This machine will greatly increase our ability to discharge these obligations. There is undoubtedly great potential need for such a machine in this region."

Quentin B. Graves, assistant civil engineering professor of the University of Texas, has been serving as acting sanitary engineer of South Dakota this summer at the request of the State Department of Health. He is helping with a special sanitary engineering project, covering the state, with headquarters at Pierre.

Delos M. Palmer, former dean of the college of engineering at the University of Toledo, Ohio, has entered the firm of Forster, Wernert and Taylor, Toledo industrial engineers. It was under his direction as dean that the Toledo college was accredited by the Engineers Council for Professional Development.

Dr. H. P. Hammond, dean of the school of engineering at Pennsylvania State College, says the United States will be short more than 75,000 trained engineers and scientists until at least 1950. Dean Hammond, who has been awarded this year's Lamme medal, a top honor in the field of engineering education, based his prediction on the decreased number of college graduates during the war. It will require several years to make up for that.

The Committee on Professional Education of the American Public Health Association, of which William P. Shepard, M.D., is chairman, is undertaking a program for the accreditation of schools of public health. The Association of Schools of Public Health had recommended that the A.P.H.A. "create a properly constituted accrediting body to carry forward progressively a list of universities qualified with regard to program, personnel, and facilities, to offer adequate courses leading to the degrees of Master of Public Health, Doctor of Public Health, and the Diploma in Public Health." This was followed by a similar request to the association from the Surgeon General's Committee on Postwar Training of the Public Health Service.

The association now announces the inauguration of the project with funds made available through the Commonwealth Fund, and with the appointment of Prof. C. E. A. Winslow of New Haven, Conn., as the counsellor in charge of the investigative work. He will be aided by persons experienced in the administration of health departments, chosen from various localities throughout the country.

Incinerators costing $4½ million proposed for Los Angeles County

Six units with total daily capacity of 3,700 tons recommended by engineer committee to eliminate smoking refuse dumps

Elimination of smoke nuisance from smoldering fires in refuse dumps in Los Angeles County, Calif., can be accomplished by the installation of six incinerators, according to a report made by a committee of engineers appointed by the Los Angeles Board of Supervisors. Residents in the county have been loud in their denunciation of smoke conditions in the area.

The committee's report calls for six incinerators to be constructed at an estimated cost totaling $4,610,000, with a capacity for burning 3,700 tons of refuse every 24 hours. These are to be located in and about the metropolitan area. It was thought the average operating cost would run about $1.75 per ton with $2,000,000 covering expenses for a year, this figure to include costs of hauling refuse to the nearest disposal site.

Financing the project

Two plans for financing the project were recommended, one, by a district bond issue, the other by lease with option to purchase. By the latter method, construction would be undertaken by contractors under a ten-year lease to the district with option for the district to purchase at the end of that period at a nominal sum. A suitable method for the administration of the project is still being worked out by the Los Angeles County Council.

It was pointed out that the incinerators will remove the odor nuisance because high enough temperatures can be maintained to destroy the odors which now occur from burning in open dumps.

Members of committee

Members of the committee which prepared the report were: A. H. Adams, acting chief engineer of the Los Angeles County Regional Planning Commission; H. P. Cortelyou, engineer-director of the Bureau of Maintenance and Sanitation; City Engineer J. C. Albers of Glendale; City Engineer George E. Baker of Long Beach; City Engineer Glenn M. Jain of Torrance; and W. M. Jarrett, assistant city engineer, Alhambra.

Other agencies have also been called in by Los Angeles city officials to help solve the smoke problem. The U. S. Public Health Service and the California Institute of Technology were recently requested by Mayor Fletcher Bowron to study the situation and give their advice.

To ask for bids soon on Cuyahoga River Bridge

With WPB approval obtained and the project already approved by the Cleveland, Ohio, city council, City Engineer John C. Wenrick expects to ask for contractors' bids on the $200,000 repair and rebuilding job slated for the Center Street bridge, spanning the Cuyahoga River, in that city's "Flats".

About $200,000 is the estimated cost for putting in a new floor, strengthening trusses and lateral bracings, installing new rollers and a new roller track and for new electrical apparatus, since the current used to swing the bridge to allow for the passage of boats up the Cuyahoga, is being changed from D.C. to A.C. to make for smoother operation.

Rebuilding of the Center Street bridge was made necessary to care for the extra traffic which will use that span when the Main Street swing bridge is torn down in December. Removal of the Main Street bridge was ordered more than two years ago by the War Department as a menace to navigation.

Beach Erosion Board given wider authority

Wide expansion of the authority of the Chief of Engineers, through the Beach Erosion Board, to make general investigations with a view to preventing erosion of the shores of the United States, is contained in H.R.2032, recently signed by President Truman. Under the new law the cost of the general investigations will be borne wholly by the United States. The former law, Act of June 26, 1936, is repealed by the new measure.

As used in the new Act, the word "shores" includes the shore lines of the Atlantic and Pacific oceans, the Gulf of Mexico, the Great Lakes, Lake Champlain and estuaries and bays directly connected with these bodies of water. Lake Champlain is a new addition to the list of bodies of water subject to investigation. In addition to participation in cooperative investigations and studies with agencies of the various states and determining the most suitable methods for the protection, restoration and development of beaches, the Beach Erosion Board will publish from time to time such useful data and information regarding the erosion and protection of beaches as the board may deem to be of value.

The Beach Erosion Board, in making its report on any cooperative investigations and studies relating to shore protection work will, in addition to other matters upon which it may be required to report, state its opinion as to the advisability of adopting the project; what public interest, if any, is involved in the proposed improvement and what share of the expense should be borne by the United States.

The new law had the support of Secretary of War Stimson.

• • •

Canada makes survey of technical personnel

A survey of technical personnel in Canada is being made by the Wartime Technical Bureau. Records of 33,909 men and women registered with the bureau have been examined and it was found that 12,486—or more than one-third—were engaged on "temporary" work. A very large percentage of these engineers and scientists will have to be transferred to other occupations soon.

The bureau is also attempting to compile data on the exact qualifications of the 1,500 persons registered but noted as merely being with the armed forces. Data for over one-third of these have been obtained.

The bureau operates under the federal Department of Labor, with the assistance of an advisory board on which the Engineering Institute of Canada, the Chemical Institute of Canada and the Canadian Institute of Mining and Metallurgy are represented.

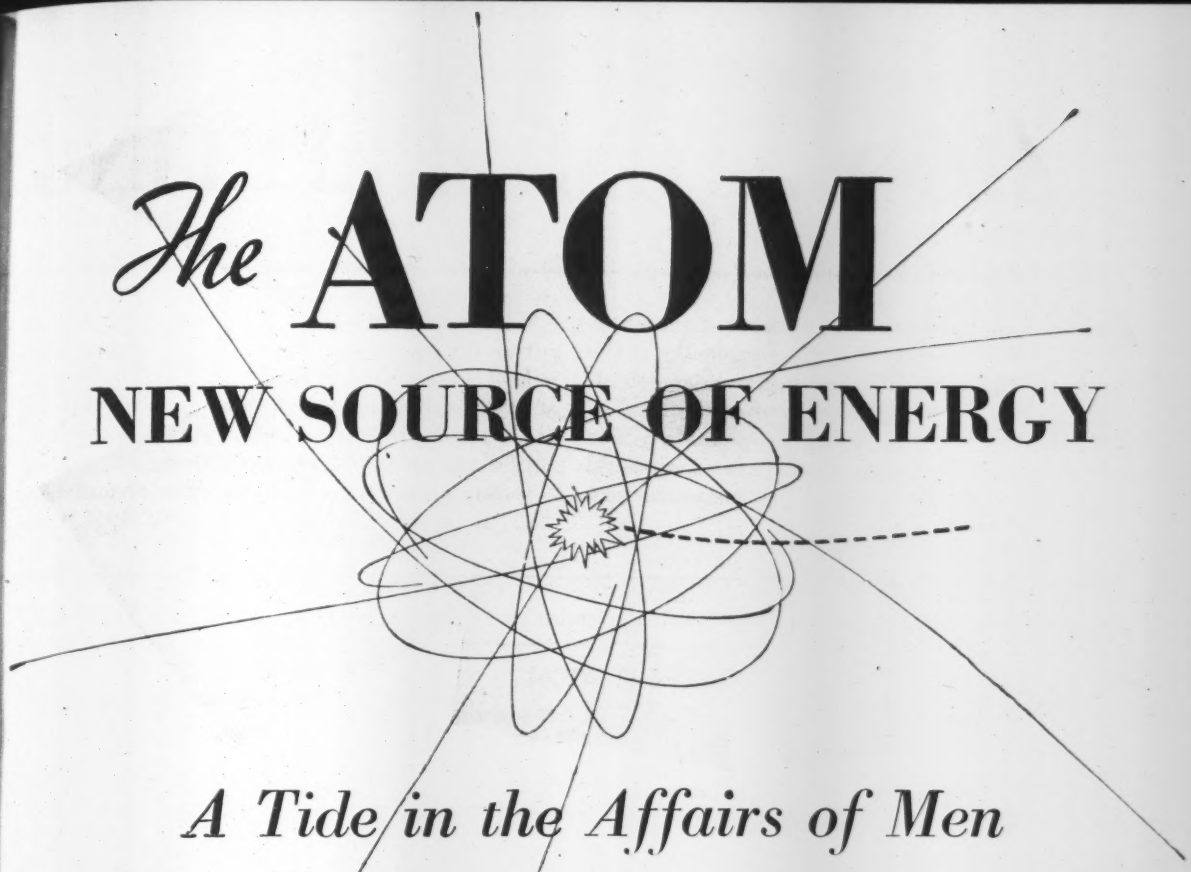
• • •

Toll collections cease on 8 Kentucky bridges

Toll collections on eight state bridges in Kentucky ceased on Aug. 18. Release of the eight bridges now leaves four state-operated toll spans. They are the Maysville Bridge over the Ohio, scheduled to become toll-free by the end of the year; the Milton-Madison, Ind., Bridge over the Ohio, the Rockport Bridge over the Green River and the Livermore Bridge over the Green.

In addition, there are other toll bridges, over which the state has no control, including the Municipal Bridge between Louisville and Jeffersonville, Ind., two privately owned bridges between northern Kentucky and Cincinnati, and one at Owensboro.

The ATOM
NEW SOURCE OF ENERGY



A Tide in the Affairs of Men

On August 6, 1945, an atomic bomb exploded over the Japanese city, Hiroshima.

Its concussion blasted the city, vaporized the fibre of Japan's will to resist, and flashed across the world a light of such glaring intensity that even blind eyes could glimpse the forked road that is presented to humanity's choice and destiny.

It has been a scant fifty years since Pierre and Marie Curie embarked upon their research with the avowed intent of discovering "how the atoms of the universe are put together". Their work contributed radium to the knowledge and use of mankind, but it marked only a way station upon the awesome quest which they announced and which thousands of scientists have since pursued.

Under the compelling stimulus of war, the first major application of the release of atomic force has been in an instrument that raises by an unimaginable dimension our ability to dole out death. We can be devoutly grateful that the scientific leadership of the Allies, and particularly the industrial strength of the United States, brought to us, rather than to our enemies, priority in the development of this dread weapon. But even in its present infant phase, it is clear that ownership of the principle of the atomic bomb carries a trusteeship of terrifying gravity.

We hold in trust a power that is capable of unraveling the very fabric of our civilization. Equally, it may be susceptible of development as a mighty force for human welfare. But we have proved the destructive use, while the constructive applications are still in the realm of speculation.

Clearly the trust is of a magnitude that transcends national jurisdiction. No walls have ever been built high enough to fence in the spread of scientific knowledge, and even if we were resolved to forego the harnessing of atomic power for peace, it is hopeless to think that its application for war can be held for long as the monopoly of one, or a small group of nations.

At one giant stride our scientific and technological development has so far outdistanced our social engineering, that we have no choice but to turn our full powers of creative imagination to control the forces we have unleashed and to bend them to man's use rather than to his destruction.

Since control is not possible without understanding, I have asked several of my editorial colleagues in the McGraw-Hill organization to present on the pages which follow a non-technical but authoritative account of the known facts and implications of atomic power.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Co., Inc.

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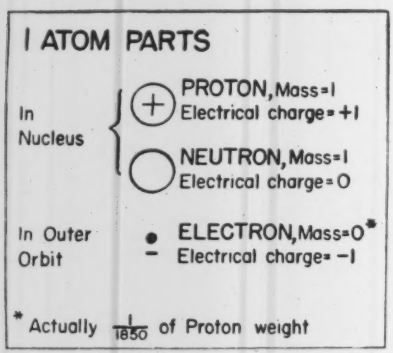
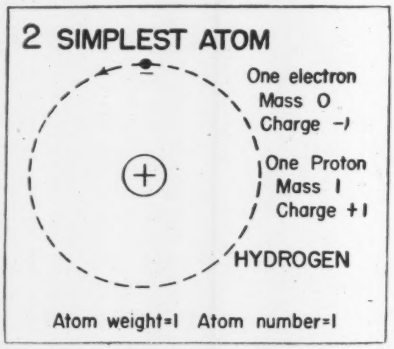
HOW ATOM SPLITTING

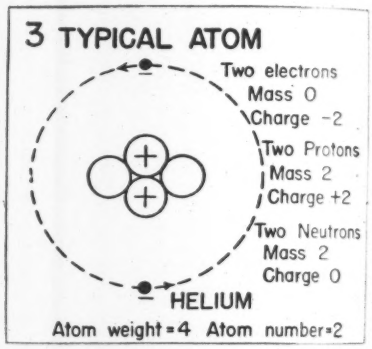
Five years ago the world learned that the atom of Uranium 235 had been split, releasing energy at the rate of about 11,400,000 kilowatt-hours per pound. The whole amount tested was less than the head of a pin, but there was no escaping the possibility that heaters, engines, turbines, jets and explosives could be powered by atomic energy. Then began the race to win the war with atoms.

With what help England could give, America outran the best atom-splitting team Germany could muster. It was all done in silence. From the summer of 1940 until the atomic bomb blasted Hiroshima, black secrecy blanketed history's most amazing scientific and industrial accomplishment.

Coldly scientific in form, the War Department's "Smyth Report," released August 12, 1945, traces

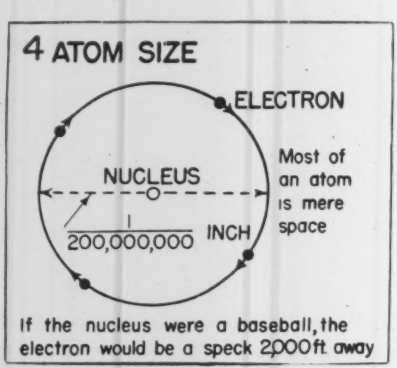


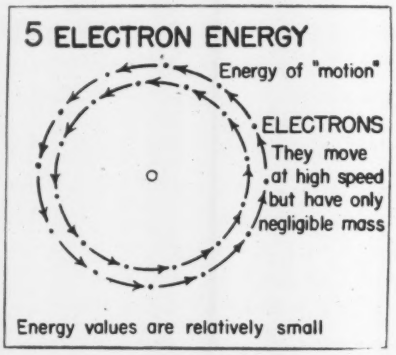


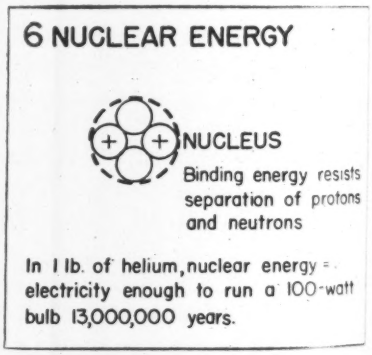


Each of the 92 elements has its own *atom*, yet all atoms are made from the same three pieces, Fig. 1: *proton* (weight 1, electric charge +1), *neutron* (weight 1, charge 0), *electron* (weight 0, charge −1).

Every atom is a tiny "solar system." Its central "sun" has one or more protons, generally neutrons too. The revolving "planets" are electrons, one for each proton in nucleus, because plus and minus must balance in the atom. The opposite charges attract, but high speed keeps the electrons out in their circular orbits, just as the centrifugal tendency of the revolving earth defies the sun's gravitational pull. All the weight of an atom is in the nucleus, so add the number of protons and neutrons to get the atom's weight. The *atomic number* is equal to the number of protons. The elements are known by their atomic numbers. Thus uranium (92 protons) is element 92.


4 ATOM SIZE
ELECTRON
NUCLEUS
Most of an atom is mere space
1/200,000,000 INCH
If the nucleus were a baseball, the electron would be a speck 2,000 ft away


5 ELECTRON ENERGY
Energy of "motion"
ELECTRONS
They move at high speed but have only negligible mass
Energy values are relatively small


6 NUCLEAR ENERGY
NUCLEUS
Binding energy resists separation of protons and neutrons
In 1 lb. of helium, nuclear energy = electricity enough to run a 100-watt bulb 13,000,000 years.

With only their outermost orbits touching, it would take half a million atoms to span the thickness of a human hair. Yet if one could expand an atom until its outer orbits encircled 100 acres, the nucleus would be no bigger than a baseball. The atom is mostly empty space, Fig. 4, and nuclei are difficult targets; so much so that a neutron bullet fired at a mass of atoms may pass right through without a hit.

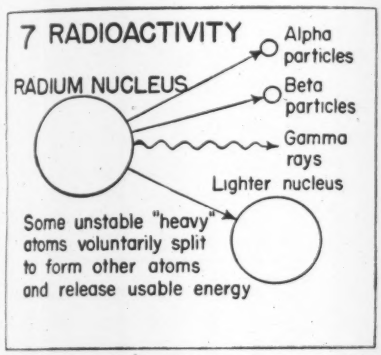
The almost weightless speeding electrons, Fig. 5, supply all the energy of chemical reactions (as when coal burns or TNT explodes). Evading all ordinary chemical action, the immensely greater energy bound up in the nucleus, Fig. 6, can be released only by direct hits on the nucleus to break the bonds that hold the protons and neutrons in a tight bundle.

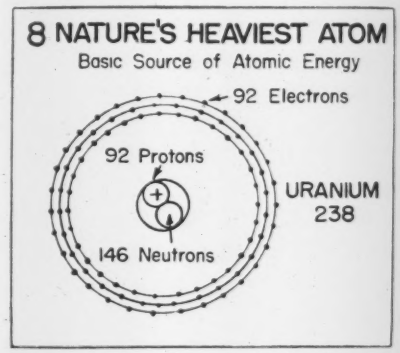
RELEASES ENERGY

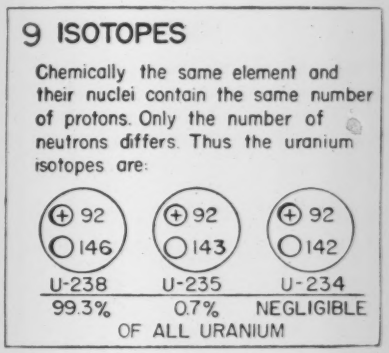
the fantastic course of atomic engineering through the five years of news blackout. It leaves no doubt that only a complete mobilization of America's technical resources could have won this victory in time.

Other writers in other places will unfold the epic story. This presentation leaves no space to reflect the glory of the accomplishment or even to record its history. The aim is more immediately practical — to give the professional and business readers of the McGraw-Hill publications a sound and honest, though non-technical, understanding of this atom-smashing business, so that they will know better what to do about it in their personal and business lives.

Now for step one: learning the shape of atoms and how atom splitting releases energy.

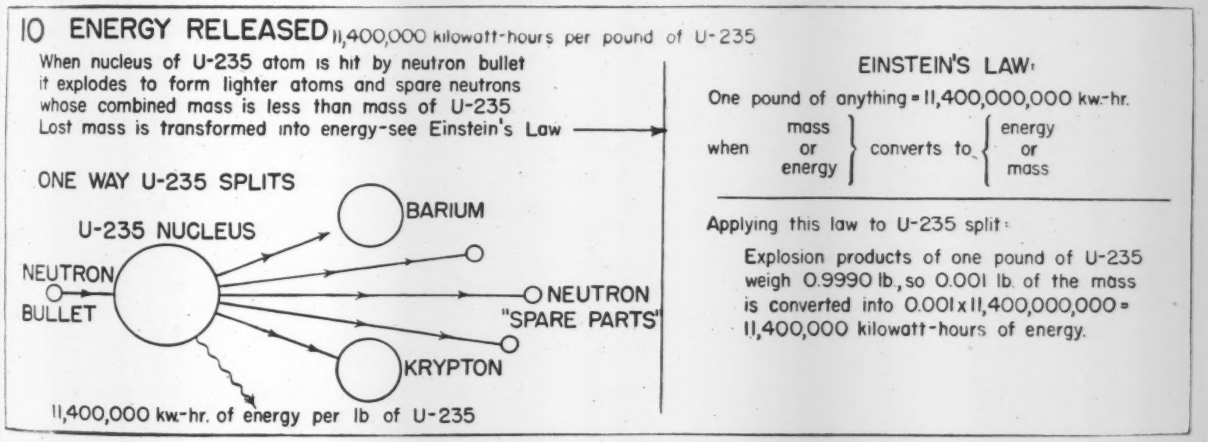






Radium nucleus, Fig. 7, automatically emits particles and energy as it decays to form nuclei of a lighter atom. Most common form of uranium, nature's heaviest atom, is Uranium 238, Fig. 8. This form is not directly useful for energy release, but is important as the raw material for a new synthetic power atom, *plutonium*.

An element may have several *isotopes* — alternate forms with the same number of protons but slightly different numbers of neutrons. Uranium 238 is the isotope in which protons and neutrons total 238 (so atom weight is 238). It is 99.3% of the total weight of pure, natural uranium. The stuff needed for direct atomic-energy release is Uranium 235, only 0.7% of the total weight and very difficult to separate from 238. To put it another way, every pound of energy-giving U-235 comes mixed with a dead load of 140 pounds of relatively inert U-238.


10 ENERGY RELEASED 11,400,000 kilowatt-hours per pound of U-235
When nucleus of U-235 atom is hit by neutron bullet it explodes to form lighter atoms and spare neutrons whose combined mass is less than mass of U-235 Lost mass is transformed into energy-see Einstein's Law
ONE WAY U-235 SPLITS
U-235 NUCLEUS
NEUTRON BULLET
BARIUM
NEUTRON "SPARE PARTS"
KRYPTON
11,400,000 kw-hr. of energy per lb of U-235
EINSTEIN'S LAW:
One pound of anything = 11,400,000,000 kw-hr.
when mass or energy converts to energy or mass
Applying this law to U-235 split:
Explosion products of one pound of U-235 weigh 0.9990 lb., so 0.001 lb. of the mass is converted into 0.001 x 11,400,000,000 = 11,400,000 kilowatt-hours of energy.

Slow neutron bullet splits Uranium 235 nuclear target, generating two lighter atoms (Fig. 10 shows one possibility) and several free neutrons ready to split other U-235 atoms. The following pages show how the original neutron may be produced and directed and how a chain of self-propagating atomic explosions may sweep through a block of U-235 like a forest fire to release heat energy equivalent to 11,400,000 kilowatt-hours per pound.

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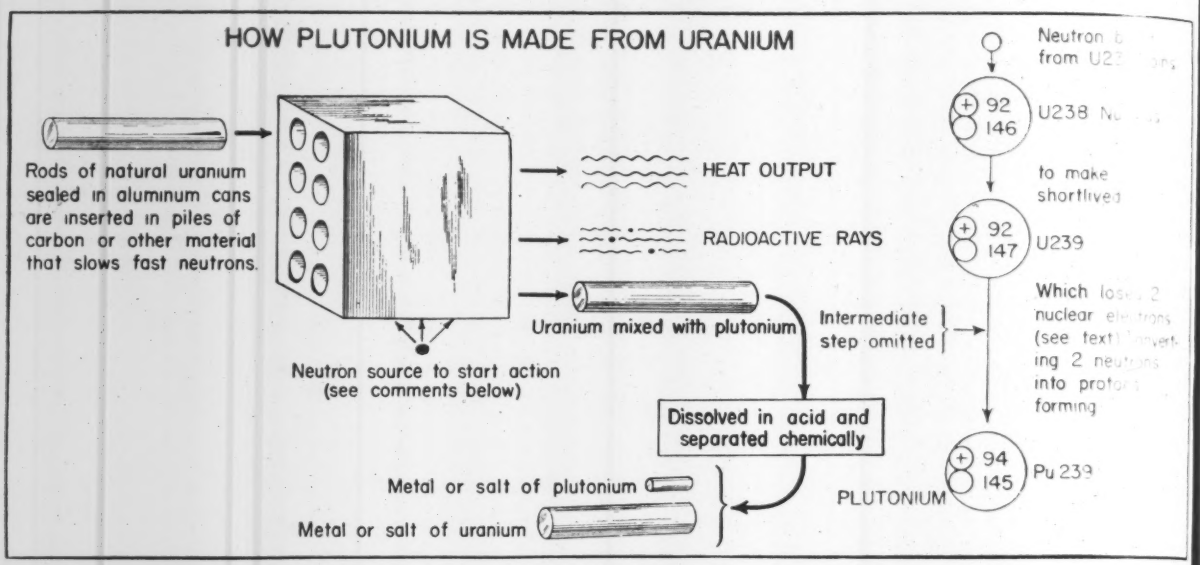
CREATING and ISOLATING

Man-Made Plutonium—U-235 Substitute



We now have two kinds of atoms suitable for energy supply, Uranium 235 and the new man-made element No. 94, plutonium. Uranium, No. 92, has the heaviest atom of any natural element.

The Manhattan Project's plant, on the Columbia River at Hanford, Washington, is the world's greatest atom-making factory. Devoted entirely to the mass production of plutonium atoms, it uses U-238 as the raw material and U-235 as the energy source, intimately mixed in the same proportions as in natural uranium metal.

The production units at Hanford are several huge uranium "piles." Each is a very large block of graphite with holes in which are placed uranium-metal cylinders, sealed in aluminum cans to protect the uranium from corrosion by the cooling water constantly pumped through the pile.

Each pile runs itself, so to speak. Not even the conventionally pictured bits of radium, beryllium and paraffin are needed as a "pilot light" to start operation. There are always enough stray neutrons, or even cosmic rays, to start a chain reaction.

But once started, the design, size and control of the unit must be such that the chain reaction will continue at an even rate — neither die down nor overshoot into an explosion.

To see this picture in atomic terms, consider the fraction of a second in which one million U-235 nuclei are split, producing two million lighter atoms (say, one million of barium and one million of krypton) and between one and three million fast-moving neutron projectiles.

Some of these escape in free flight right through the relatively vast atomic "open spaces." Some are "captured" by the many U-238 nuclei, and others are captured by the impurities. But, on the average, of the one to three million, just one million neutrons must succeed in smashing another million U-235 atoms in the next fraction of a second. Thus, with reproduction rate exactly maintained, life goes on in the atomic-energy pile.

The carbon, one of several possible "moderators," serves to slow down the neutrons without capturing many. The chance of a fast, straight-moving neutron hitting a tiny nucleus is very small, whereas the "slow ball" neutron is likely to be sucked in by the nuclear attraction if it would otherwise be a near miss.

From the practical angle, maintaining a chain reaction requires careful design and good controls. The pile must be slightly larger than actually necessary for a chain reaction (that means scores of tons of material). Controls must be sensitive and dependable. They slow the pile down to the balancing point by sliding in retarders, such as strips of cadmium.

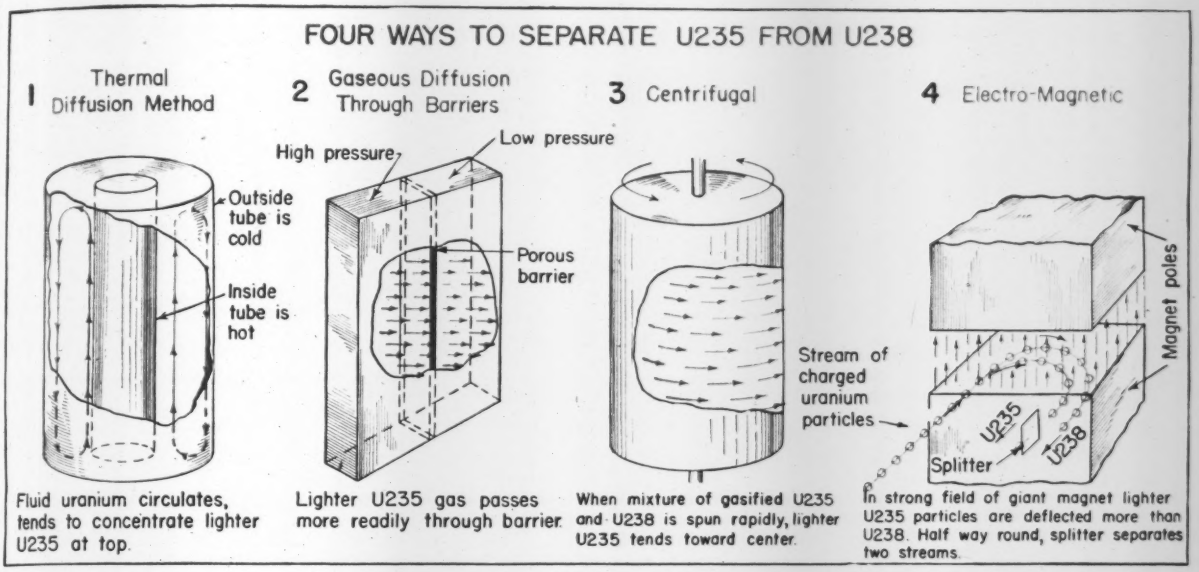
As already noted elsewhere, the energy released is about 11,400,000 kilowatt-hours for each pound of U-235 split. This energy appears first in the high speed of the pieces thrown off by the atomic split, then is converted to sensible heat as collisions slow down these projectiles. The energy is finally removed from the pile in the form of hot air, steam, hot water or other heated fluid in commercial quantity and thermal condition.

Such piles, operated with normal uranium, or with uranium enriched in U-235, would seem to be the primary means by which atomic energy will serve (if ever) as a commercial source of heat and power. Plutonium would be a byproduct, but might under certain conditions add to the energy yield of the pile without the need to separate it from the uranium.

The use of normal uranium in the Hanford pile sounds extremely attractive as a heat source, but has certain economic disabilities. Only a small part of the U-235 is used up before the pile must be shut down to remove the plutonium.

THE HIGH-POWER ATOMS

Isolating U-235 — a Gigantic Task


FOUR WAYS TO SEPARATE U235 FROM U238
1 Thermal Diffusion Method
2 Gaseous Diffusion Through Barriers
3 Centrifugal
4 Electro-Magnetic
Outside tube is cold
Inside tube is hot
High pressure
Low pressure
Porous barrier
Stream of charged uranium particles
Magnet poles
U235
U238
Splitter
Fluid uranium circulates, tends to concentrate lighter U235 at top.
Lighter U235 gas passes more readily through barrier.
When mixture of gasified U235 and U238 is spun rapidly, lighter U235 tends toward center.
In strong field of giant magnet lighter U235 particles are deflected more than U238. Half way round, splitter separates two streams.

Many of the uranium ores, including most samples of pitchblende and carnotite, will yield from 1 to 15% metallic uranium. Chemical separation of the metallic "natural" uranium is simple. Whatever the source, natural uranium contains the three isotopes in the constant proportions of 99.3% U-238 and 0.7% U-235, with traces of U-234.

Separating the U-235 from U-238, an operation essential for explosive uses of U-235, and probably important for future commercial controlled-chain piles, has been most difficult. Chemical separation was impossible because U-235 and U-238 are chemically the same.

The only possibility was a separation by physical differences, primarily a one percent difference in weight. The porous barrier and centrifugal methods pictured above required vaporizing a salt of uranium. All the methods shown have been used or tried on the Manhattan Project. All require many stages to achieve a substantial concentration of Uranium 235.

Dollarwise Thoughts on Atomic Energy

Costs mean little in war, but peacetime uses of U-235 and plutonium must pass the dollar test in competition with coal, fuel oil, natural gas, gasoline and electricity.

On the basis of energy costs only, *"all other things being equal,"* the table on the last page of this section shows at what price per pound U-235 would give the same energy cost as conventional energy sources selling at the indicated prices. For such comparisons it is convenient to remember that one pound of U-235 is equal (energy-wise) to about 11,400,000 kilowatt-hours, also to 1500 tons of coal, or 200,000 gallons of gasoline.

Fuel engineers understand the limitations of such oversimplified comparisons. Others should be warned that "all other things" are never equal. With this thought in mind, reconsider the uranium piles operated at Hanford to produce plutonium. These use U-235 in the cheapest form, say about $1400 per lb., assuming purified normal uranium at $10 per lb. (140 lb. of uranium contains one pound of U-235.)

If this were the whole story, coal would have to sell for a dollar a ton to break even with U-235 as a water heater. However, the pile using normal uranium must be immense to hold its own in a chain reaction. More important, the accumulating fission products "poison" the reaction after only a small part of the U-235 has been used up. Then the uranium cylinders must be removed for plutonium recovery. Finally, it has not yet been found possible to operate the normal-uranium piles at high enough temperatures for practical power production.

If we go to the other extreme and build a small pile, using concentrated U-235, we shall run into excessive material costs, perhaps several times the $52,000 per lb. set down in the table as the equivalent of 20-cent gasoline.

Something between the two extremes is likely to prove the most economical — perhaps a pile operating on a U-235 concentration between 1 and 10%.

The engineer of the "atomic-power age" must know the price of Uranium 235 *in various concentrations* and the characteristics of piles suited to them. No such information is yet available. He must also watch the danger from radio-activity; the requirements for radiation shields; explosion hazards, etc.

CONTINUED ON NEXT PAGE

WHAT TO EXPECT

Before discussion of possible and probable future applications of atomic energy to the arts of peace, the atomic bombs should have consideration. We may assume that these bombs contained from two to 200 lb. of either U-235 or plutonium, or both. No more precise information is available.

Details of the bomb design have been completely suppressed, but the following basic considerations are stated or implied in the Smyth Report:

The explosive in a bomb must be highly concentrated U-235 or plutonium. Since slow neutrons could not produce a satisfactory explosion, the neutron retarder or *moderator*, is minimized. This, in turn, requires a U-235 mass so large that the escape of neutrons without hitting nuclei will not be excessive. For every 1000 atoms hit, the neutrons produced must split more than 1000 new atoms, so that the reaction will proceed rapidly in an expanding chain, as sketched below.

There can be little leeway in the size of the explosive charge. For a given shape there is a certain "critical" weight of material. If this is exceeded the bomb explodes instantly. If the weight of charge is less than the critical, it cannot be made to explode.

Therefore, the critical mass must be created at the moment of explosion.

The Smyth Report suggests that this can be accomplished by breaking down the charge into two or more well-separated parts, each having less than the critical mass. At the appointed moment these could be brought together within the bomb to create a supercritical mass, which would then explode automatically.

CLAIMS LIKE THESE ARE NOT JUSTIFIED

1. Pretty soon no more coal will be mined except as a raw material for chemical manufacture.

2. In a few years a tiny bit of uranium, built in at the factory, will drive your car for life through an engine no bigger than your fist.

3. All the big central stations will soon be running on atomic power.

4. Cheap atomic energy will enormously reduce the price of power.

Peacetime Applications

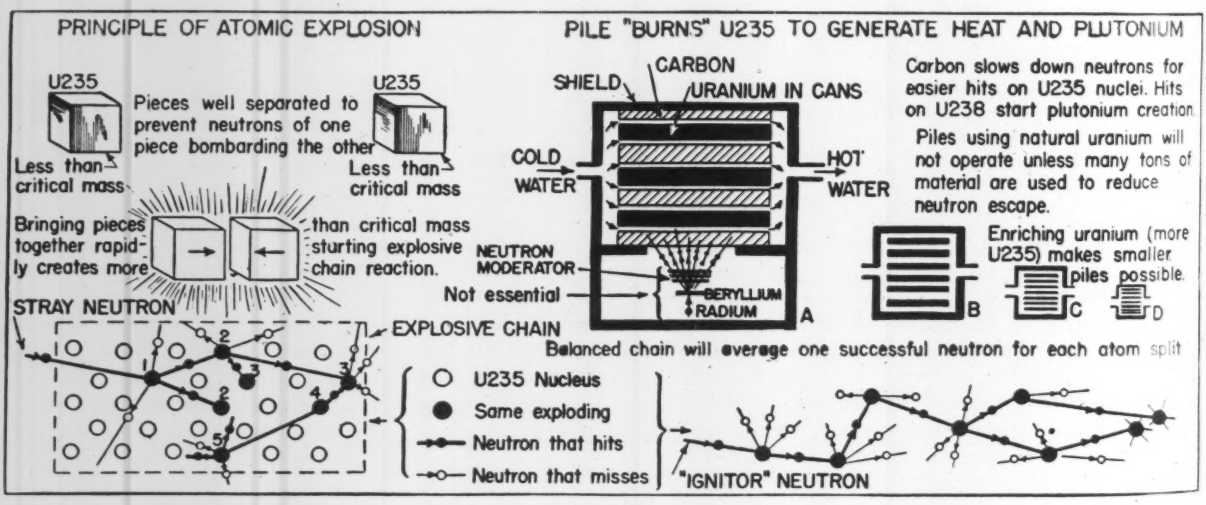
Except possibly for superblasting operations, uncontrolled explosive reactions cannot be permitted in the peacetime use of atomic energy. This means that the quantity of U-235 assembled in any one spot must always be kept well below the critical weight to avoid spontaneous explosion.

Depending on the particular application, the most desirable concentration of U-235 may range anywhere from the 0.7% in normal uranium up to 100%, with the probability that many industrial applications will find the greatest economy in concentrations between 1% and 15%.

This matter of the degree of concentration of U-235 has received little public attention, yet nothing could be of greater practical importance. To make this point clear, consider the two extremes, 0.7% of U-235 and 100% of U-235, respectively.

The Hanford pile, using normal uranium (0.7% U-235) with carbon moderator, must be very large to work at all. It is inefficient in the sense that it must be shut down after a small part of the U-235 has been consumed. It cannot operate at high temperatures.

Its great advantage as a heat producer is the fact that its U-235 is bought at the lowest possible price. If


PRINCIPLE OF ATOMIC EXPLOSION
U235
U235
Pieces well separated to prevent neutrons of one piece bombarding the other
Less than critical mass
Less than critical mass
Bringing pieces together rapidly creates more than critical mass starting explosive chain reaction.
STRAY NEUTRON
EXPLOSIVE CHAIN
PILE "BURNS" U235 TO GENERATE HEAT AND PLUTONIUM
SHIELD
CARBON
URANIUM IN CANS
COLD WATER
HOT WATER
NEUTRON MODERATOR
Not essential
BERYLLIUM
RADIUM
A
Carbon slows down neutrons for easier hits on U235 nuclei. Hits on U238 start plutonium creation.
Piles using natural uranium will not operate unless many tons of material are used to reduce neutron escape.
Enriching uranium (more U235) makes smaller piles possible.
B
C
D
Balanced chain will average one successful neutron for each atom split
U235 Nucleus
Same exploding
Neutron that hits
Neutron that misses
"IGNITOR" NEUTRON

FROM ATOMIC ENERGY

. . . BUT REMEMBER THESE FACTS

1. The large-scale, controlled release of heat energy from U-235 has been fully demonstrated.

2. Beyond question, this energy could be applied directly for heating water and air, and making steam.

3. Such heat, in turn, could be applied directly, or converted into mechanical power or electricity by conventional steam turbines and gas turbines.

4. If and when U-235 in concentrations up to 10% costs less than $25,000 per lb., it may find applications, but will compete, at first, with premium fuels rather than coal.

purified normal uranium sells for, say, $10.00 per lb., the price of 140 lb. (containing one lb. of U-235) will be only $1400. This would be a very favorable price if the pile could operate efficiently with the 0.7% U-235.

Concentrating the U-235 to 100% would permit a much more compact and convenient pile — perhaps little more than small pieces of U-235, encased in aluminum to ward off corrosion, and immersed in a tank of water; this should convert the water into steam at a regulated rate.

In large part, the control would be inherent. The water as a moderator would keep the chain going, but if the reaction got too violent, the resulting higher superheating of the steam would decrease the moderator effect and thereby hold the reaction in check. Yet even if all this comes true the cost of concentrated U-235 in the near future will be many times $10,000 per lb.

Running up the concentration only a few percent above that in normal uranium may prove to be the way to get reasonable pile size and good efficiency without incurring exorbitant concentration costs.

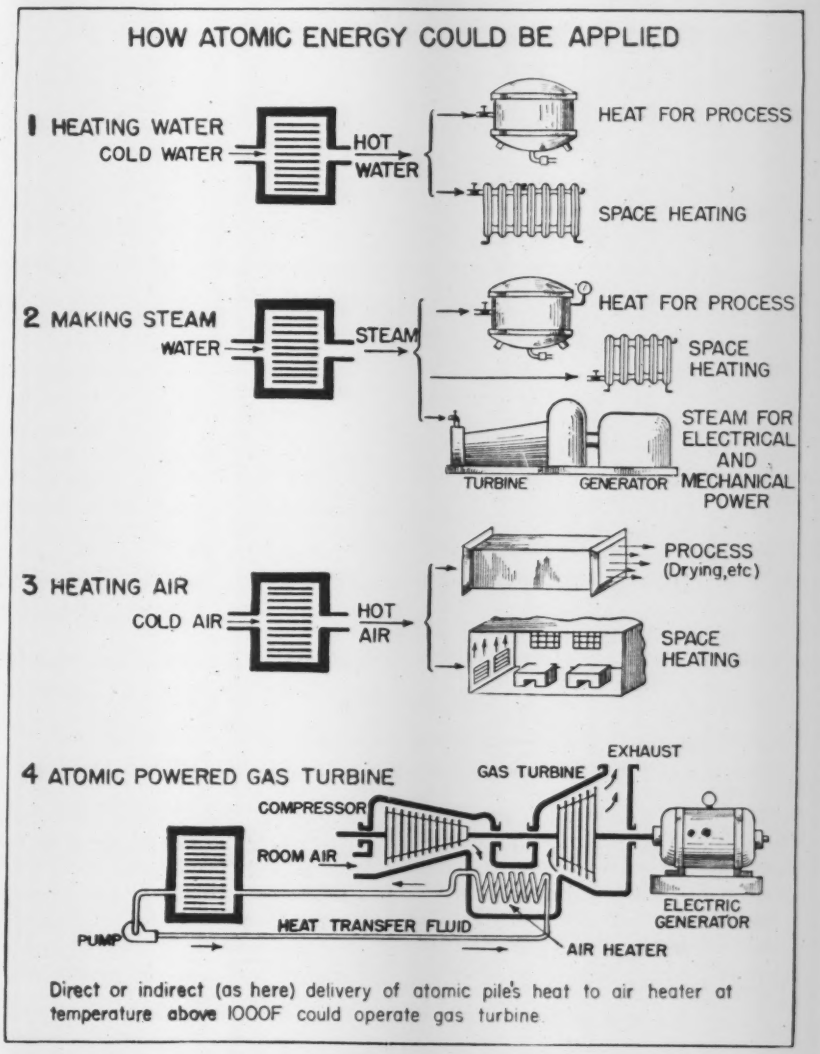
When atomic energy is applied, the starting point is heat, picked up by water, air or a special heat-transfer fluid. Intermediate heat transfer fluids may be essential in certain applications (space heating and service water, for example) where people must be protected from injury by radioactivity.

The intermediate heat-transfer fluid shown for the gas turbine would, of course, have to operate at temperatures up to 1200 F. There seems to be no basic reason why the pile itself could not be built inside the compressed-air receiver, discharging its heat directly to the compressed air.

With rather high concentration of U-235, this arrangement might be suitable for large airplane drive if excessive weight of radiation shields could be avoided.

Also, presumably, rockets and planes of the "buzzbomb" type could be powered by atomic heat delivered to the air of the jet steadily, not in puffs.

The sketches stress direct applica-



Direct or indirect (as here) delivery of atomic pile's heat to air heater at temperature above 1000F could operate gas turbine

THESE THINGS MIGHT RESTRICT USE OF ATOMIC ENERGY

1. Ineffectiveness of large piles using normal U-235 concentration
2. High cost of concentrated U-235 for smaller, more effective piles
3. Danger from radioactivity
4. Weight and cost of shielding against radiation
5. Explosion hazard
6. Possible short supply of uranium
7. Governmental restrictions on atomic-energy materials

tions of hot air, steam and hot water to process and space heating. This emphasis is justified by the often overlooked fact that such applications of heat have many times the total energy value of all the electricity generated in the United States for all purposes.

There has been much popular speculation regarding the type of engines required for atomic-power generation. The answer is simple. Present engines, steam turbines and gas turbines can be used with little or no change. This, of course, does not rule out the possible discovery of specialized engines for atomic power, or even direct production of electricity from atomic energy.

In the long run the implications of atomic power are staggering for both war and peace. However, popular writers on the subject have undoubtedly created unreasonable hopes in the minds of readers — for example, the expectation that in two or three years the Detroit builders will market cars with built-in "lifetime" slugs of U-235 and "fist-sized" engines.

Yet it seems fairly safe to predict that atomic energy will find some commercial applications within the next five or ten years, first, probably, as a premium fuel like aviation gasoline, worth a fancy price for specialized applications where low weight or some other characteristic is important.

As the cost of concentrating U-235 is reduced and application efficiencies improved, atomic energy may compete with cheaper fuels, perhaps ultimately with coal.

Important non-power applications of atomic energy may well include the ultra-high-temperature processing and fabricating of materials — also, modern "alchemy": building and rebuilding atoms to create new elements and to produce old elements at lower costs.

Radioactivity obtained directly or indirectly from artificial atom-splitting should find many important medical and industrial applications.

Turning back to ordinary power applications, we must avoid the temptation to overstress the economic importance of lower-cost power fuel. Fuel cost is only about 17% of the gross receipts of the electric utilities. Here's another way to put it: If, after allowing for transmission losses, one kilowatt-hour delivered to the consumer from modern plants represents a coal consumption of 1.5 lb., and if the coal costs $5.00 per ton cancellation of the coal bill could not save more than ⅜ of a cent per killowatt-hour. And atomic fuel will certainly not be free.

Performance of the atomic bomb is a monument to the scientists who unlocked the secrets of the atom and suggested the basic technique of making plutonium and concentrating U-235.

From there on, the job was at least 50% engineering. The various big plants of the Manhattan Project are vast assemblages of pipes, tanks, boilers, valves, instruments and controls, installed and operated by engineers, largely designed by engineers. From now on, the speed with which atomic power becomes practical will depend on the effectiveness of the engineer-scientist team.

It is possible, of course, that national controls may completely upset the entire technical and economic pattern of this discussion. For reasons of national security the government may decide to control or restrict atomic-power materials, plants and operations in ways not yet determined.

U-235 COULD COMPETE AT THESE PRICES
other things being equal

Common fuel	*Assumed prices*	*Comparable prices for Uranium 235, dollars per pound (nearest thousand)*
COAL	$6 per ton	$9,000
(13,000 B.t.u.)	$12 per ton	$18,000
	$15 per ton	$23,000
FUEL OIL	2¢ per gal.	$5,000
(150,000 B.t.u. gal.)	4¢ per gal.	$10,000
	8¢ per gal.	$20,000
CITY GAS	50¢ per 1000 cu. ft.	$39,000
(500 B.t.u.)	$1 per 1000 cu. ft.	$78,000
NATURAL GAS	25¢ per 1000 cu. ft.	$10,000
(1000 B.t.u.)	50¢ per 1000 cu. ft.	$20,000
	$1 per 1000 cu. ft.	$40,000
GASOLINE	10¢ per gal.	$26,000
(150,000 B.t.u. gal.)	20¢ per gal.	$52,000
	30¢ per gal.	$78,000

BUT

Note that "other things" are never equal. U-235 in normal uranium form is by far the cheapest, but involves use of excessively large and inefficient "piles." The unit cost of the U-235 in enriched mixtures increases with the degree of enrichment. Over-all cost comparisons can be made only for a specified concentration of U-235 and for apparatus suitable for that particular concentration. Possible explosion danger and need to protect personnel against radiation are other important considerations.

Canada's contribution toward the atomic bomb

Contributions of Canada's civil engineers and contractors to the development of the atomic bomb have been shrouded in secrecy until relatively recently when C. D. Howe, Minister of Munitions and Supply, revealed that some time ago the federal government had acquired an area of some 28 square miles along Deep River, adjacent to Chalk River village, on the Ottawa River to the west of Ottawa.

In this highly protected area, a special plant has been under construction by the Fraser Brace Co. Ltd., of Montreal for Defence Industries Limited, wartime subsidiary of Canadian Industries Limited, operated for the Dominion government. Water supply from the Ottawa River, and adequate power supply from the transmission system of the Ontario Hydro Electric Power Commission, were deciding factors in the location of the plant, details of which have not been released.

The ore from which the vital uranium is obtained has come from the El Dorado Mine in the Northwest Territories of Canada, on Great Bear Lake. The mine was taken over some time ago by the federal government.

Transportation facilities have held the key to the development of this and other far northern mines. Apart from air transport for special purposes, water transport on the Mackenzie River system has been the means of transporting all supplies and all construction and mine equipment. This has involved rail shipment to the railhead at Waterways, Alta., 300 miles north of Edmonton, then water transport on barges to Fort Fitzgerald 400 miles north, transfer on the 17-mile portage road around the great Smoky Rapids, transfer back on to barges for the 900-mi. voyage to the Bear River, transfer again to trucks for portage around the rapids, and transfer back again to boats for the final sail across Great Bear Lake.

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Central Valley group, its work done, disbands

Its purpose accomplished, the Central Valley Project Association, formed in 1933 to promote construction of California's huge multiple-purpose Central Valley Project, disbanded late in August as it appeared all major CVP units were nearing completion.

With original appropriations totaling $130,000,000, the CVP was approved by Congress in 1935. Wartime construction obstacles have delayed completion of portions of the project.

LCRA must pay state for utility tax loss

Upholding a legislative act, the Texas Supreme Court recently ruled that the Lower Colorado River Authority must pay out of its revenues sums in lieu of taxes on public utility properties which the Authority now owns.

The court held that the LCRA could not be considered a public agency that is entitled to tax exemption. The legislature previously had said that the LCRA should pay from its revenues amounts equal to taxes that would have been paid by the privately owned utilities the Authority had taken over. Bondholders challenged the validity of the legislative act.

Welding library seeks to extend collection

The A. F. Davis Welding Library at Ohio State University, Columbus 10, Ohio, desires assistance in extending its collection of books, manuscripts, articles or documents relating to welding. Engineers doing research are invited to send their papers to the library for permanent filing. Also being sought are patent numbers of any patents pertaining to welding, welded equipment, welded machine design or welded structural design. The facilities of the library are open to students and others interested in research or seeking information on welding and its applications.

JOBS OF THE WEEK

PETROLEUM RESEARCH LABORATORY, Linden, N. J.

George A Fuller Co., New York, N. Y., has been awarded a contract for a petroleum research laboratory on 60-acre tract by Standard Oil Company of New Jersey, New York, N. Y. The estimated cost is $5,000,000. Voorhees, Walker, Foley & Smith, New York, N. Y., are the architects.

AQUEDUCT, San Diego, Calif.

Guy F. Atkinson Co. Long Beach, was the lowest bidder for part of San Diego Aqueduct when Bureau of Yards & Docks, Navy Department, Arlington, Va., opened bids at $1,164,884.

WATER SUPPLY PROJECT, Roanoke, Va.

The city received lowest bid for water supply plant and reservoir for Carvins Cove water supply project from Ralph E. Mills and Blythe Brothers Co., Roanoke, $514,600; for pipe from Leo Butler, Silver Springs, Md., $627,662. Alvord, Burdick & Howson, Chicago, Ill., are the engineers.

ABSORPTION PLANT, Angleton, Tex.

Stearns Rogers Co., Denver, Colo., has been awarded a contract for an absorption plant for Stanolind Oil & Gas Co., Houston, at $4,500,000.

PAVING RUNWAYS SHOULDERS, Idlewild, N. Y.

Goll & DeFelice, Brooklyn, N. Y., have been awarded a contract by Department Marine and Aviation, New York City, for paving shoulders of runways A, B and C, Idlewild, at $1,896,951.

HOSPITAL, Elgin, Ill.

William E. O'Neil Construction Co., Chicago, Ill., was the lowest bidder on constructing Diagnostic Treatment Building, at Illinois State Hospital, at $897,553. Department Public Welfare, Springfield, opened bids. C. Herrick Hammond, Springfield, is the state architect.

COSMETIC MANUFACTURING PLANT, Clifton, N. J.

Ford, Bacon & Davis, New York, N. Y., will design and construct a 2-story, 250x400-ft. limestone and glass plant for the manufacture of cosmetics for Shulton, Inc., New York, N. Y. The estimated cost is $1,000,000.

HOUSING, Cedar Point, Md.

Wilaka Construction Co., New York, N. Y., was the lowest bidder for 300 prefabricated demountable units when Public Housing Authority, Washington, D. C., opened bids, at $956,000.

HOUSING UNITS, Camden, Ark.

Forcum James Co., Memphis, Tenn., was the lowest bidder for constructing 500 family housing units when Public Housing Authority, Washington, D. C., opened bids, at $1,389,200. Wittenberg & Deloney, Little Rock, are the architects.

Note—Additional bidding and contract news on many projects large and small, including the above items appear in the Construction News section beginning on page 17.

OBITUARY

Albion Noyes Van Vleck, 59, until 1939 first deputy commissioner of the New York City Department of Housing and Buildings, died Aug. 22. Since 1939 he had been in private practice as an engineer. He subsequently was employed as a civilian engineer by the Army Quartermaster Corps in connection with the construction of Camp Wheeler, Ga. He was educated in Washington, D. C., schools and at Lehigh University, where he received a degree in civil engineering. He started in 1908 as a structural draftsman. He worked, in turn, for Post & McCord, the J. B. & J. M. Cornell Co., and the American Bridge Co. In 1911 he became assistant chief engineer for F. M. Andrews, New York City architect, and from 1913 to 1917 he held a similar position with Guy Lowell, architect, of New York and Boston. In the latter year he joined the Army and saw service in the artillery, rising to the rank of major. In 1919, he became assistant general manager for the Saginaw Shipbuilding Co., Saginaw, Mich. In 1922 he was employed by J. E. R. Carpenter, New York City architect, as chief engineer. In 1927 he became a partner in the consulting engineer firm of Hurlbut & Van Vleck. He left that position in 1933 to become a senior engineer in charge for the Federal Works Administration.

Charles E. Boyd, 75, president and manager of the B. H. Construction Co., Massillon, Ohio, and vice president of the Stark County Construction Council, died Aug. 16.

John A. Fallgreen, 56, city engineer for Auburn, Kent and Sumner, Wash., died Aug. 14 at Seattle. A native of Wisconsin, he worked for the Seattle Port Commission before moving to Auburn 22 years ago.

George Brown, Jr., civil engineer with the North Carolina State Highway and Public Works Commission, located at Waynesville, N. C., died Aug. 16.

Henry Irving, 71, a civil engineer who retired in 1943 after 38 years in the service of New York City, died Aug. 21 in Miami, Fla. He had been with the Department of Docks for 24 years and with the Department of Water Supply, Gas and Electricity for 14 years.

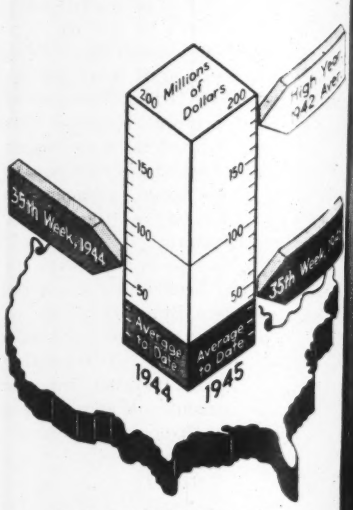
John P. McInerney, 56, superintendent of building construction for the New York World's Fair and construction supervisor of the Empire State Building, died Aug. 26. Mr. McInerney was a graduate of Cooper Union. When a young man he was employed by the Fuller Construction Co. on the building of the Pennsylvania Railroad terminal in New York. As a captain in the first World War, he directed the work on Kelly and Langley airfields.

After that war, Mr. McInerney returned to Fuller as a superintendent of construction in New Orleans and in Detroit, where he supervised the work on the Free Press Building, and the 47-story Penobscot Building.

John Quincy Rankin, 63, a consulting civil engineer for the U. S. Engineers at the port of embarkation, Brooklyn, N. Y., died Aug. 25. Mr. Rankin was graduated from Rensselaer Polytechnic Institute in 1904. Joining the Foundation Co. in New York, he worked as a civil engineer on the construction of foundations for bridges, grain elevators and other large structures in this country and Canada. In 1923 he founded his own engineering firm in New York. At the outbreak of the war he rejoined the Foundation Co. to build a shell loading plant in Kentucky for the Navy.

Charles B. Wing, 81, emeritus professor of civil engineering at Leland Stanford Jr. University, died Aug. 22 after long and distinguished service to nation, state and his home community. Born in New York State, he was graduated from Cornell in 1886 and taught there for three years before going to the University of Wisconsin as professor of bridge and hydraulic engineering. He went to Stanford in 1892 as professor of structural engineering and for many years worked in close cooperation with the late Charles D. Marx whom he succeeded as head of the department of civil engineering. This position he retained until he reached the age of retirement. Included in his record of outstanding achievements are supervising reconstruction of the Stanford University buildings following the 1906 earthquake, the design of the Stanford stadium and the design, or service as consultant on, many structures of note including bridges, dams and wireless towers of record height. In the 22 years during which he was executive member of the California State Park commission, the number of state parks increased from three to 80. He was elected mayor of Palo Alto in 1910 and for 20 years thereafter was a leader in community affairs. Following World War I he went by the title of colonel in recognition of the rank of lieutenant-colonel attained while serving with the Army Engineers in France.

CONSTRUCTION ACTIVITY



As Reported This Week to... *Engineering News-Record*

CONTRACT VOLUME

Continental U. S. Only (Thousands of Dollars)

	Week of Aug. 30 1945	Cumulative 1945 (35 wk.)	Cumulative 1944 (35 wk.)
Federal	$3,726	$648,308	$821,9
State & Munic.	12,490	218,880	168,0
Total Public	$16,216	$867,188	$989,9
Total Private	19,084	393,911	271,7
U. S. Total	**$35,300**	**$1,261,099**	**$1,261,6**

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Type of Work	Dollar Volume (Thousands) This Week	Cumulative 1945 (35 wk.)	Cumulative 1944 (35 wk.)
Waterworks	$937	$35,416	$21,9
Sewerage	546	21,440	20,9
Bridges	870	22,387	9,7
Highways	6,090	147,137	145,0
Earthwork, Waterways	730	33,016	47,8
Buildings, Public	3,418	399,922	464,1
Industrial	17,175	263,686	122,3
Commercial	500	78,005	108,8
Unclassified	5,034	260,090	321,7

NOTE: Minimum size projects include are: Waterworks and waterway projects $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	1945 35 wk.	Cumulative 1944 35 wk.
NON-FEDERAL	$551,865	$334,3
Corporate Securities	114,940	91,8
State and Municipal	273,325	101,7
RFC Loans	24,600	87,7
REA Loans	60,000	20,0
Fed. Aid, Highway	79,000	63,0
FEDERAL	$1,049,898	$1,262,5
Total Capital	**$1,601,763**	**$1,596,8**

ENR INDEX NUMBERS

Index Base = 100		1913	19
Construction Cost	Aug. '45	309.08	144
Building Cost	Aug. '45	239.94	125
Volume	July '45	119	83